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Welded alloy steel excavator dipper is lighter and as strong as the cast dipper design used formerly. Output is speeded up because of snappier swing action. Photo through courtesy of Bucyrus-Erie Co., South Milwaukee, Wis.

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Protect Your Eyes!

WE ARE TOLD that every year hundreds of industrial workers lose their sight and that thousands of others suffer serious eye injuries through occupational accidents. Eye hazards are one of the major causes of blindness. Safety supervisors express surprise at the average worker's carelessness and sometimes complete indifference to the dangers to which his eyes are unnecessarily exposed. At a large industrial plant recently, the safety "boss" encountered a man who more often than not preferred to wear his safety goggles on his forehead rather than where they belonged—in front of his eyes. Of what value are safety devices like goggles and welding helmets, if welders and fit-up men fail to use them? Every man working in an eye-hazardous occupation should remember that it is much more sensible and certainly much cheaper to prevent accidents than to incur the discomfort, loss of income and heavy expense entailed.

It is stated on good authority that millions of dollars are paid out every year for medical fees and compensation awards to industrial workers who have been totally or partially blinded and millions of dollars are lost through lowered efficiency and lessened capacity following blindness or impairment of vision.

It is not possible to estimate in terms of money the tragedy that enters into the home of any man who has been blinded or has lost part of his sight permanently. The man so afflicted is confronted with the problem of learning a new trade and many times is so incapacitated that he can no longer be the bread-winner for his family. When so many able bodied men are unemployed there are very few jobs for men with impaired vision. For purely selfish reasons this situation is certainly something to be kept in mind all the time. The accident hazards are created chiefly by flying chips of metal or other hard materials or hot molten particles of metal or slag. The hazards of excessive eye fatigue are those due to insufficient light or extremely glaring light such as obtained from the welding arc, or oxy-acetylene flame. These hazards can be prevented by using suitable protective equipment, such as goggles and welding helmets, respirators, etc. Metal or canvas screens are also helpful in a welding shop. With safety equipment readily available there is little excuse for taking chances. The loss of eye sight is irreplaceable.

A man cannot see anything through an artificial eye.

Helpful Trade Literature

MANUFACTURERS of welding equipment and supplies seem to have a pretty keen sense of the value of the educational type of industrial advertising. Men who have devoted many years of intense application to the job of planning and executing industrial advertising, seem to be in agreement on one important point—the educational function of industrial advertising is clearly its most important function. Copy prepared for business and technical papers and for bulletins, booklets, pamphlets, folders, etc., for distribution to customers and prospects, is most always designed to do a good educational job. Any welder, welding foreman, or welding engineer can gain much helpful technical information of a very specific nature if he will avail himself to the fullest of this excellent literature on welding.

The money which has been expended for educational material of this nature is a measure of the real effort being put forth by the leaders in our industry to advance the application of welding in all industries. Certainly no one familiar with the type of highly useful technical literature now available, without cost to the user, can point an accusing finger at industrial advertising and make the ridiculous claim that such advertising is an economic waste. On the other hand, the money so expended undoubtedly fulfills a very important economic want and helps everyone who seeks to improve his use of welding to do so and by so doing to make product improvements which have important significance in our general economic well being.

By way of example we herewith review some of the valuable booklets we have listed in our "Trade Literature" columns the past several months: (1) "How To Change Over to Welded Design For Profits"; (2) "Manual of Steel Construction," for engineers interested in design, fabrication and erection of structural steel for buildings and bridges; (3) "Heavy Coated Electrodes," containing technical data on 20 different types for diversified welding jobs; (4) "Metal Sprayed Surfaces in Relation to Lubrication"; (5) "Portable Hydraulic Welding Guns and Equipment"; (6) "Hard-Facing for Rural Shops," for the job shop owner in rural areas; (7) "Split-Second Welding Control," special controls for improvement of resistance welding; (8) "Welding Instructions and Standards—Part I," covers new A. W. S. symbols and a list of various types of welded joints, filler metal properties, etc. These are but a few of the current offerings all available to our readers.

YOU CAN WELD 1001 JOBS 15% FASTER WITH THE 6-IN-1 *"Shield-Arc"*

THE JOB SELECTOR of a Lincoln *"Shield-Arc"* Welder enables you to lower costs by having your pick of any TYPE of arc. It gives you selectivity and range equal to 6 special welders. You can get an arc that is especially designed for overhead or vertical work, one for high-speed, deep-groove welding, one for delicate tool welding, one for sheet metal, one for alloys, etc. In fact, you can get an arc of *any* characteristics you need to do the best welding possible on all classes of work. And at each setting of the Job Selector, you can get any SIZE of arc with *"Shield-Arc's"* Current Control for any one of 1001 welding jobs.

Users of the 6-in-1 *"Shield-Arc"* report that its selectivity and range increases welding speed, improves weld quality and lowers costs as much as 15%. Mail the coupon for a free copy of a booklet which gives complete details.

LINCOLN
LARGEST MANUFACTURERS OF ARC WELDING EQUIPMENT IN THE WORLD

THE LINCOLN ELECTRIC CO., Dept. CC-485, Cleveland, O.
Send a free copy of the book explaining how I can lower welding costs with the *"Shield-Arc"* Welder.

Name _____ Position _____
Company _____
Address _____
City _____ State _____

Reception committee which greeted P. G. Lang, president of A.W.S., as he alighted from train in Los Angeles to attend the Western Regional Conference and Third Western Metals Exposition.

From left to right: F. C. Fantz, C. P. Sander, K. V. King, Wayne Howard, P. G. Lang, Turner M. Smith, J. C. Blake, P. D. McElfish, H. P. Etter and E. O. Williams.

Record attendance features the

Western Metals Congress

★ Attendance at technical sessions exceeded 5000 — Exposition auditorium housed 158 equipment exhibits — Floor sales were reported to be over a million dollars

THE THIRD WESTERN METALS CONGRESS AND EXPOSITION has passed into history. Held at the Pan-Pacific Auditorium, in Los Angeles, with an attendance of over 36,000 visitors during its five-day show, which ended March 25th, the attraction was acclaimed an outstanding success by the many groups and individuals who attended the show or participated in the interesting program.

Over 3,000 engineers and metal experts were registered at the Metals Congress, and attendance at the several sessions of the 18 national technical societies numbered over 5,000. Predominately, these men represented the leading industries of the western part of the United States, all prominent leaders in their respective fields. The results of this conference, the third of its kind in recent years to be held on the Pacific Coast, have been very beneficial, and have had much to do with the development of a wider interest in welding, and in moulding a more favorable opinion and understanding of welded construction in this part of the country.

Interest of a high quality, both in the welding conference papers and in the exhibits at the exposition, seemed very evident, and a whole-hearted spirit of cooperation in promoting the programs for the ultimate good of all who attended seemed to pervade the Congress. A wealth of information and technical data was made available, and much benefit was derived from witnessing the practical and instructive tests and operating demonstrations.

The Exposition auditorium housed a total of 158 exhibits featuring materials, products and equipment for acquainting the user, fabricator, heat treater and foundryman with the latest and best metals and alloys available, as well as various means and processes for their use and application.

Showing that industrial men of the 11 western states are shouldering their way out of the depression and are inspired by the motive of the Congress,

Well arranged exhibit of Union Carbide and Carbon Corp.

Lincoln Electric Co. had an inviting booth. Welding demonstrations were conducted during the show.

W. H. Eisenman, secretary of the American Society for Metals, said that 1¼ million dollars worth of metals and machinery was sold from the floor of the exhibition. Tremendous interest was shown in new developments. Attendance mainly was drawn from the 11 western states, although approximately 500 visitors from the East were present, many of them appearing on the technical programs or in the booths of the exhibits.

Welding Predominates

Of special importance and interest to our readers is the undisputed fact that of the many exhibits at the Exposition, those featuring welding and its application in industry overshadowed all other exhibits by their number and attention-getting appeal.

The Western Regional Conference of the A. W. S. began its deliberations at the opening session on Monday morning, the 21st, in the Biltmore Hotel. At noon the same day, the conference held a luncheon meeting in honor of P. G. Lang, the society's president. This meeting was attended by a group of about 75 of the leading industrial executives of Southern California. A welcoming address was delivered by the convention chairman, E. F. Scattergood, of the Los Angeles Bureau of Power and Light. In his address, Mr. Scattergood discussed many contributions which his organization has made to the advancement of welding. President Lang responded with an excellent address dealing with welding problems encountered throughout the country, and commenting particularly on the extensive adoption of welding by the leading railroads of the United States. He stated that engineers and executives in that industry are rapidly becoming more "welding minded."

Display of Victor Equipment Co.'s line of equipment and General Electric welders, electrodes and accessories.

Stuart Oxygen Co. display included latest type of oxy-acetylene gas manifolding system. A Rego welding torch was given away each day in a welder's "guessing contest."

A full list of all the papers presented at the regional conference was published in our February, 1938 issue, pages 31-32.

Dinner Dance

One of the outstanding events of the week's activities was the banquet and dance held on Thursday evening at the Biltmore Bowl. This social and entertainment feature was a brilliant affair, long to be remembered and was much enjoyed by all who attended. Bob Hope of Paramount Studios was "master of ceremonies," and many other prominent movie stars and notables from Hollywood added interest and color to the occasion. In addition to Mr. and Mrs. Lang, many of the officers of the national technical societies and their wives and friends were in attendance. A sparkling floor show and dancing concluded the evening's entertainment.

Many special events and attractions were featured each day of the Exposition. Demonstrations of various kinds were given at the different booths during the show. "Whitey" Maurath, president of Maurath, Inc., Cleveland, O., with his smiling countenance and pockets filled with novelties for his friends was a familiar figure to everyone at the Exposition.

A well arranged and attractive booth was set up by Victor Equipment Co., San Francisco and Los Angeles, displaying its line of welding and cutting torches, regulators, etc., together with a line of General Electric welding units, electrodes and accessories, Victor being a local distributor for G. E. Demonstrations with both types of equipment were conducted during the show.

An attractive booth was that of the Lincoln Electric Co., Cleveland, Ohio. This concern's line of electric welders, and several types of electrodes and accessories were on display. Welding demonstrations with various types of rods and with different machines were conducted.

The Moore Machinery Co., of Los Angeles and San Francisco, exhibited Westinghouse "Flex-Arc" welders, Hollup "Sureweld" electrodes, and a new Federal automatic spot welder. A recent U. S. Navy aerial practice bomb, manufactured on a seam welder was on display, as well as a hot-water heater tank of Monel metal, also welded by the same machine. Welding demonstrations with a spot welder, attracted many people.

The Stuart Oxygen Co., Los Angeles, had an attractive display of oxygen and acetylene tanks together with their latest type of oxy-acetylene gas manifolding systems. Continuous demonstrations were given with Rego torches on welding and cutting. The new two-stage Regolator was introduced to the visitors. The welding or die-cast white metal was of interest to many experienced oxy-acetylene welders who had believed that white metal could not be welded. A Rego welding torch was given away each day to the visitor guessing nearest to the correct total number of pieces of metal welded during every eight hours of the demonstration.

Stoody Company, Whittier, Calif., and the Haynes Stellite Co., Kokomo, Ind., exhibited metal-cutting tools, hard-facing metals, and equipment for the application of same by both oxy-acetylene and electric welding.

The United States Steel Corp. booth, with its distinguishing architecture, drew much attention and interest. This exhibit featured a talking miniature stainless steel robot as "master of ceremonies." By a clever mechanical arrangement, a series of large photographic transparencies depicted manufacturing methods employed in the production of various types of carbon and alloy steels, each of which was properly timed in its presentation.

Air Reduction Sales Co., and the Linde Air Products Co., both had rather elaborate exhibits comprising their several types of oxy-acetylene welding and cutting apparatus and accessories.

The Metallizing Company of America gave numerous demonstrations of the operation of their metallizing gun, showing the metal spray process of building up worn shafts as well as for other types of work.

Welded Housing Salvages a Flooded Motor

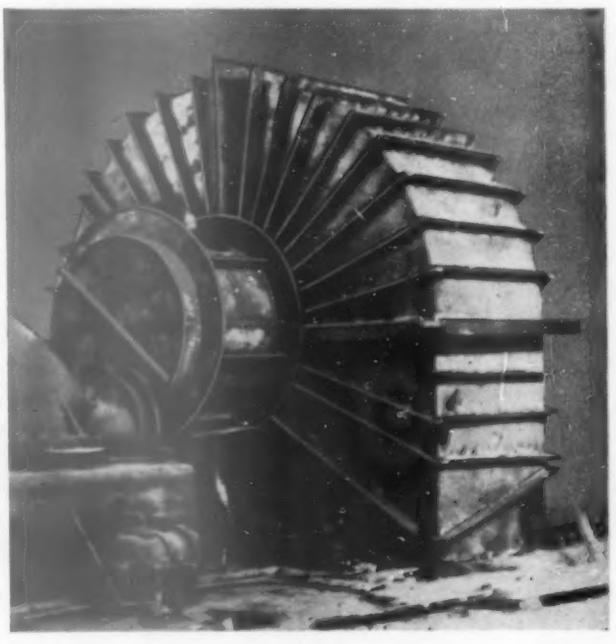
By HENRY K. DE VRIES*

During the floods of the Ohio River early last year, when a large part of the property occupied by the plants of the Andrews Steel Co., Newport, Ky., was flooded, a number of pieces of valuable machinery were completely submerged. Among this equipment was a 3,000-hp. electric motor that remained under water for more than a week.

The method used to dry out this motor, in order to fit it once more for service, was not only unusual, but also proved to be highly effective. The application of any great amount of heat was, of course, out of the question because of almost certain injury to the insulation of the motor windings. It was decided, therefore, to construct an air-tight housing around the motor and to employ both heat and vacuum. In this way, because of the greatly reduced boiling point of water under vacuum, it was possible to boil out all moisture from the motor at a temperature low enough to be safe.

The welded steel casing, built around the motor and shown in the accompanying illustration, was 12 ft. long and 5 ft. wide with a drum on each side to enclose the shaft. Made of ¼ in. low carbon steel plate, reinforced with steel bars and I-beams, it was completely electric welded in place, using carbon-molybdenum steel electrodes which had been salvaged from the flood. Despite the fact that these electrodes had been submerged for at least 14 days, they not only worked well, but, a test of the welded housing showed only one small leak which was quickly plugged.

*Mr. DeVries is associated with American Murex Corp., New York.



All welded steel housing for vacuum drying a 3,000-hp. motor.

New automatic process for

Resistance Welded Tubing

★ Bicycle plant installs new type production equipment to handle steel tubing — No external flash

A NEW ELECTRIC resistance welding production line, comprising five welders, has just been installed by the Cleveland Welding Co., Cleveland, Ohio, for production of bicycles. This company, specializing in automotive and high production items, entered the bicycle field two years ago, and in that time has become one of the large manufacturers of bicycles in this country. From the start this company has endeavored to put its bicycle production line on the same high production basis as its other products, and the recent development and perfection of a resistance welding process applicable to tubing has rendered this possible.

This process, known as the Hart process, covered by U. S. Patent No. 2,091,982 and other patents pending, exclusive rights to which are owned by Steel and Tubes, Inc., Cleveland, Ohio, a subsidiary of Republic Steel Corp., is a process of joining two tubes, or a tube and another article by means of electric resistance welding to form a joint that is said to be strong, and without any external flash to be later removed. The Cleveland Welding Co. operates under a license from Steel and Tubes, Inc.

The Hart process consists essentially of three major steps: Reinforcing the tube ends; Preparing the tube ends for welding; Welding. To obtain maximum strength with light-gauge tubes, it is necessary to reinforce the ends of the tube to provide greater wall thickness for the welds. If the tubing has a comparatively heavy wall, or if maximum strength is not necessary, reinforcing is not required. Reinforcing is done by expanding the end of the tube slightly for a distance of 1 in. or 1-½ in. by means of a punch. Into this expanded end a reinforcement is placed. In bicycle construction this is generally a tube of about 14 gauge material, knurled with a heavy cross knurl. After the reinforcement is placed within the tube, the tube is pressed through a die, drawing the end of the tube down over the knurled reinforcement to the original diameter in such a way that the points of the knurl are firmly imbedded in the inner wall of the tube. This makes a very fine mechanical and electrical connection between the tube and the reinforcement. This reinforcement provides a heavier wall at the end for welding and distributes the stress away from the actual joint. Fig. 1 is a photograph showing steps in the reinforcing process.

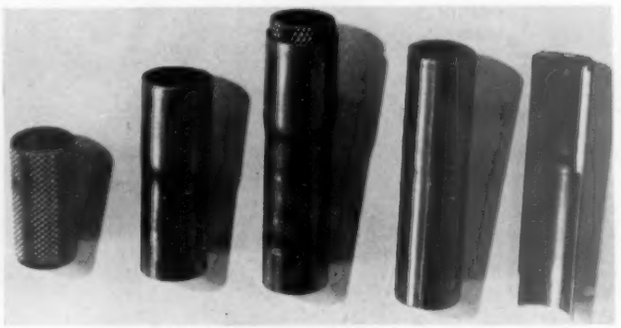
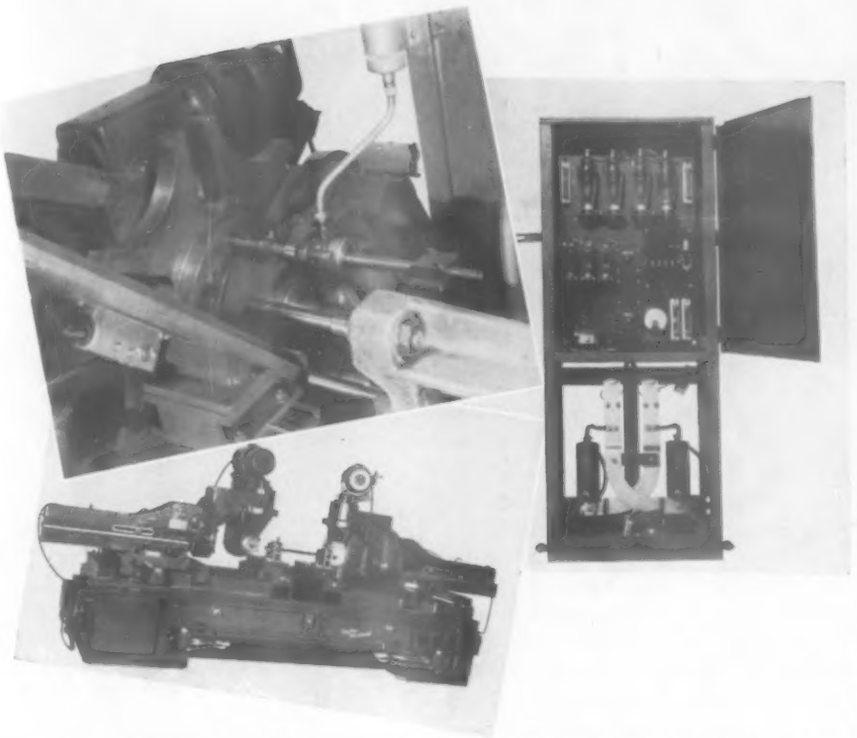


FIG. 1—Knurled reinforcement, tube expanded, reinforcement placed within expanded tube, drawn down over knurled reinforcement, cutaway section of finished tube end.

In production, this reinforcing is done in the special automatic machine shown in Fig. 2. This machine, developed specially for this purpose by the Taylor-Winfield Corp., Warren, Ohio, is fully automatic. Tubes to be reinforced are placed in a rack at the right hand end of the machine and the reinforcements are loaded into a hopper. The operation of this machine can best be explained by tracing the progress of one tube. The tube drops into guides and is moved forward through a die, then an indexing mechanism carries it forward one station, in which position a punch expands the end of the tube. It is then carried into the next position where a second punch places the insert in the expanded end of the tube. It is then indexed to the third station where a plunger forces the tube and reinforcement back through the die, drawing the tube down to the original diameter. All three punches are carried on a single hydraulic ram so that at each stroke all three operations are performed. The indexing is controlled by a Geneva movement and the complete operation results in one finished reinforced tube end with each stroke of the hydraulic plunger.

The second step in the process is the machining of the reinforced tube end in such a manner that a line contact is made at the inner edge of the tube only, leaving a small wedge shaped space extending away from this line contact to the outer edge. This con-



tour is made simply with a special high-speed form milling cutter which mills two ends simultaneously. Figure 3 shows this milling machine set up to mill the two ends of the brace bar of a bicycle frame. Another setting of the same machine mills the tube which runs from the crank hanger to the head. With this machine it is merely necessary to place the tube within air-operated clamps (not shown in photograph) and press the button shown on the front of the machine. The tube is clamped in position, the two heads move up at high speed almost into contact, then a slow feed comes into play during the actual milling at the end of which the two heads return and the clamp opens. This machine is capable of handling approximately 700 milled ends per hour, and is universal in its application.

FIG. 2—(Upper Left)—Reinforcing machine showing hydraulic ram with 3 punches.

FIG. 3 — (Lower Left) — Semi-automatic milling machine.

FIG. 4—Electronic timer provides accurate time intervals from 1/120 to 1/ sec.

FIG. 5—A portion of the production welding line.

The third step in the process is to bring the machined tube end in contact with the other article under heavy pressure and apply a very high current for a short time. In bicycle construction the pressure is approximately one or two tons; the instantaneous demand is 150 to 250 kva. during the weld and the time interval is 4 to 10 cycles of 60-cycle current.

This is accomplished in special press welders. In making the crank hanger joint the tube is placed over a horizontal mandrel, and the tube to be welded to it is clamped vertically by Elkonite faced jaws directly under the mandrel. When the parts are in position a button is pressed and a small horizontal air cylinder operates to locate the vertical jaws on the centerline. Another air cylinder operates to clamp the vertical tube by means of a toggle. Air is then admitted to the cylinder at the top of the machine, and the roller bearing head comes down, applying pressure between the parts to be welded. The current is turned on by an electronic control for the desired length of time, and the cycle reversed. This entire cycle occupies from 2 to 3 seconds, depending on the type of joint being made. A comparable welder is used for joints similar to the head joint except a mandrel is not placed within the tube and the head is motor driven.

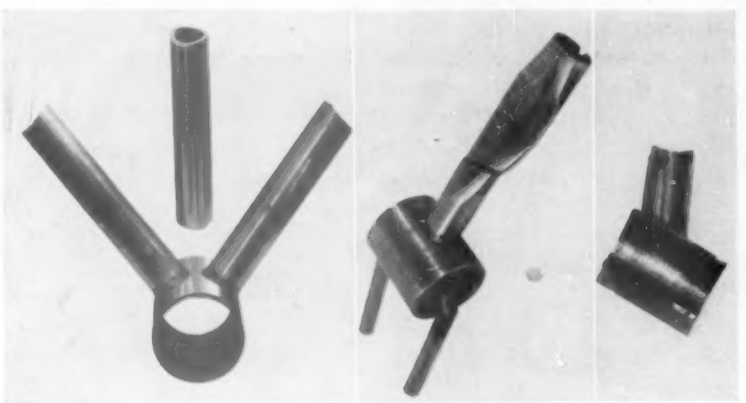


FIG. 6—Clean welded joints at crank hanger, also milled tube end ready for welding.

FIG. 7—Tensile test of welded joint.

FIG. 8—Macrograph of joint cross section illustrating complete fusion.

Timing is provided by a Westinghouse Ignitron timer shown in Fig. 4 This control does not depend upon mechanical means for closing and interrupting the current. Timing is in terms of electrical cycles, and half cycles. In the case of 60-cycle current, this means that welds can be

timed from 1/120 sec., or any multiple to ½ sec. or longer. Two Ignitron power tubes, each conducting current in only one direction, close and interrupt the welding current. The effect is that of a single-pole, single-throw switch, synchronized with the current supply. Ignition tubes contain no filament, hence there is nothing to burn out, and the current is carried in an arc through mercury vapor. In addition, a heat control is supplied whereby the magnitude of the welding current can be varied from 20% to 100% of maximum current by means of a small dial, thus avoiding auto-transformers, primary taps, and tap changes, and providing a smooth, stepless current adjustment. This heat control unit is small and is mounted on the right hand side of the welder, where it is readily accessible for changes in current. Fig. 5 shows part of the production line of welders.

The result of this welding process is said to give an absolutely clean joint that requires no finishing. Fig. 6 shows two such joints as they came from the welder, and a tube machined ready for welding.

Destruction Test

Exhaustive tests in bending, in tension and under vibration have shown the Hart joint to be stronger than the tube. Fig. 7 shows such a joint tested to destruction under tension. For over a year, repeated destructive, vibration and actual road tests, have been made on complete bicycle frames in order to subject the joints to every possible type of stress and the joints have consistently demonstrated ample strength. it is said.

Fig. 8 is a macrograph of a head joint showing the complete fusion of the outer tube, the reinforcement, and the cross tube. Change in grain structure is held to a minimum due to the rapidity with which this process takes place.

The Hart process is a machine process in every stage. The reinforcing and milling operations, once they have been set up, eliminate the human equation. The same is true of the welding operation, as the vacuum tube timing control holds the time interval to a definite figure, the current is accurately controlled and the pressure is applied mechanically. It is pointed out that consistent results and great strength are characteristic of this process of high production machine welding.

New N. E. M. A. Standards For Welding Electrodes

★ Standards for welding electrodes have recently been adopted by the Electric Welding Section of N.E.M.A. and arrangements have been made to distribute them through member companies and from N.E.M.A. headquarters at 155 E. 44th St., New York City. The principal functions of these standards are: (1) to define the various classes of metallic electrodes used in arc welding; (2) to standardize the packaging, diameters and lengths of the various types of electrodes.

For the purposes of standardization, electrodes are divided among the following nine classes: bare, thinly coated, heavily coated, high-tensile, hard-surfacing, ferrous for cast iron, corrosion and scale resisting alloy, non-ferrous and miscellaneous. This portion of the standards alone is thought capable of eliminating a large amount of confusion and misunderstanding in the trade if widely adopted. It is also helpful to have a general understanding as to how electrodes should regularly be packaged, and in what range of diameters and lengths for the various classes, other packaging and dimensions to be considered special.

Nema Standards

EW9-10 Classes of Electrodes

A. Bare Electrodes

Any mild steel electrode whose surface has not been improved for the purpose of improving the welding qualities, etc. beyond that improvement obtained through normal wire drawing practice. Final annealed wire is included in this classification.

B. Thinly-Coated Electrodes

Mild steel electrodes designed to improve the stability and performance of the arc stream, (coatings intended to change materially the physical or chemical properties of deposited materials are in Class C). Included herein are washed, sprayed, brushed, tumbled, drawn, heat dipped, or otherwise made thin coatings.

C. Heavily Covered Electrodes

Mild steel electrodes whose covering is designed to improve the physical properties of the deposited weld material. Extrusion, wrapping, dipping (or combination) or other means are included in this classification.

D. High-Tensile Electrodes

All ferrous electrodes where alloys are added to give tensile strength above 75,000 psi. in the weld metal in the "as welded" state.

E. Hard-Surfacing Electrodes

All electrodes producing a weld deposit whose property is primarily to control hardness or resist wear, such as 12 per cent manganese electrodes, tungsten-chromium electrodes, high-carbon steel electrodes, etc.

F. Ferrous Electrodes for Welding Cast Iron

All ferrous electrodes principally used for the welding of cast iron.

G. Corrosion and Scale-Resisting Alloy Electrodes

All electrodes giving a weld deposit containing chromium or chromium and nickel as the principal alloying elements, the purpose of which is to obtain a weld deposit to resist corrosion at normal, or at elevated temperatures. The following classifications fall in this group:

G-1 Chromium Electrodes

All electrodes giving a weld deposit containing chromium in excess of 1.75 per cent chromium, chromium being the principal alloying element. (These are the so-called straight chromium alloy electrodes).

G-2 Chromium-Nickel Electrodes

All chromium-nickel electrodes giving a weld deposit of the corrosion and scale resisting types.

H. Non-Ferrous Electrodes

All electrodes producing a weld deposit of essentially a single non-ferrous element or an alloy of essentially non-ferrous elements, such as copper, bronze, aluminum, nickel, copper-nickel, etc.

I. Miscellaneous Electrodes

All electrodes of a type or for purposes not defined under Classes A to H inclusive.

EW9-25 Standard Diameters

The following diameters of bare and core wire shall be standard:

(a) *Class A, B, C, D, and E*
3/32 in., ⅛ in., 5/32 in., 3/16 in., 7/32 in., ¼ in., 5/16 in., and ⅜in.

(b) *Class F, G, H and I*
3/32 in., ⅛ in., 5/32 in., 3/16 in., ¼ in., 5/16 in., and ⅜in.

EW9-27 Standard Lengths

(a) The following lengths shall be standard, (except for cast electrodes):

(1) *Class A, B, C, D, E, F, H and I*
¼ in. and larger—14 in. or 18 in.
7/32 in. to ⅛ in. inclusive—14 in.

(2) *Class G*
3/32 in. and smaller—not in excess of 11 in. ⅛ in. and larger—not in excess of 14 in.

(b) Center grip electrodes will be within these standards if their overall length does not exceed twice the above standard lengths.

EW9-30 Standard Packages

Standard packages on all S. & C. electrodes shall be as follows:

(a) *Classes A, B, C, D and E* shall be 50 lb. net contents in weight, excepting hard-surfacing electrodes under Class E which obtain their hardness through elements other than carbon and manganese.

(b) *Classes F, G, H and I* shall be 50 lb. and/or 25 lb. net contents in weight, except for those electrodes which must be packaged in smaller units on account of fragile covering.

Operator on top of tank welding the circumferential head joint.

Tank fabricator cuts welding costs with

Multiple A-C. System

★ No chipping out on underside of double-U butt welds—Arc blow eliminated—300 kva. transformer used with 80-volt secondary windings

THERE is a noticeable trend in the design of arc welding equipment toward more stable operation of the arc. With greater arc stability, less reliance is placed on the welding operator. In commenting on welding developments in Europe, Charles A. Jennings, research engineer, has recently called attention to 3-phase a-c. systems used quite extensively abroad. Installations quite similar to those which Mr. Jennings described in his talk before the Chicago Section, American Welding Society, on February 18, 1938, have been in operation in this country. In this article we will describe the recent installation of a 3-phase a-c. welding system at the plant of Hamler Boiler and Tank Co., Chicago.

Discussing this new equipment with Thomas H. Woods, superintendent of the Hamler plant, he pointed out that it is easier to weld with the new a-c. system. His statement is substantiated by the physical tests of specimens prepared in accord with paragraph U-69 of the A. S. M. E. Code governing fabrication of unfired pressure vessels. These physical tests will be described later. Mr. Woods also pointed out that the a-c. arc handles quite differently than the d-c. arc. He demonstrated this by burning a ¼ in. rod, using normal welding current of 350 amp. First striking the arc, he laid the electrode holder down on the plate and the arc continued to function, burning the rod automatically, somewhat similar to a lighted cigarette, which usually keeps on burning until all the tobacco is consumed.

Another rather dramatic demonstration of arc behavior was made by burning a hole through 1½-in. steel plate, using a ¼-in. Murex Type F electrode and 600 amp. current. The rod was pushed into the plate without extinguishing the arc. Liquid metal was, of course, forced out of the hole and formed a mound, irregular in shape, on top of the plate.

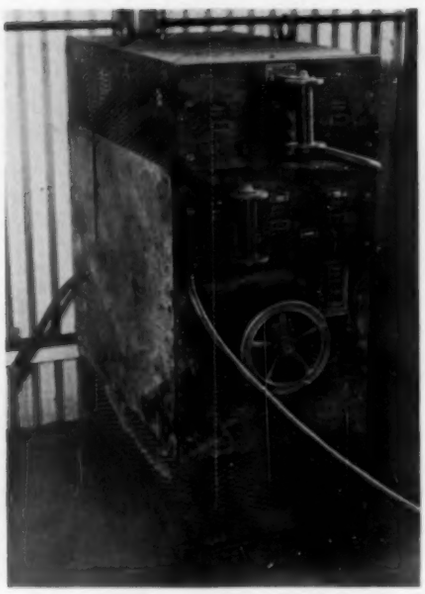
Mr. Woods claims that with the new a-c. system the welding cost after the work has been fitted up is 50 per cent less than with the d-c. system. He claims that a better weld is obtained and that no chipping is necessary on the underside of the double-U butt weld. The operator uses a wire brush to remove the slag coating. Elimination of the chipping operation is an important factor in cost reduction. It is probably the most important reason why this shop favors the a-c. multiple ring system.

Arc Blow Eliminated

It is also pointed out, in common with other a-c. systems, that the operator is not troubled with arc blow. As a result a better deposit of weld metal is obtained. It is further pointed out that the no-load power loss is lower than with a d-c. motor-generator set.

Tests were made with a number of different types of welding electrodes to determine their stability of operation with the a-c. equipment. According to

300-kva., 3-phase transformer supplies welding power to 12 "stations" in the shop.



One of the 12 welding "stations." Provision is made for control of a-c. voltage and current.

Mr. Woods, the Murex Type F 3/16-in. and ¼-in. electrodes gave most satisfactory results. With the 3/16-in. rod a welding current of 250 amp. is generally used. With the ¼-in. rod, welding current is stepped up to 350 amp. These currents are quite a bit heavier than ordinarily employed with rods of these sizes. This particular rod is designed especially for fillet welding in horizontal position. There is very little spatter loss and penetration into the plate metal is good. This will be noted from an accompanying illustration showing a fillet weld obtained with a ¼-in. electrode. This rod conforms to A. W. S. specification Grade 10.

Star-Connected Secondary

The power supply system in the Hamler shop is rather unique. The heart of the system is a huge 300 kva. 3-phase transformer with 460 volt primary windings and 80 volt secondary windings. That is, the secondary voltage is 80 volts to ground from any one of the phase wires. The transformer secondary is star connected and the neutral point is grounded.

Welding power is distributed to a series of 12 welding stations located along the side wall of the shop. Rubber-insulated stranded copper cables of 500,000 circular mil cross section are used to feed the power to the welding stations. An individual cable is run from the "mother" transformer to each station. The longest cable is 150 feet. Transposition of the 500,000 c.m. cables in the distribution conduit is so designed as to reduce the mutual inductance of the adjoining cables to a very small value.

Balanced Load Per Phase

An effort is made to balance the welding load on each phase, there being four stations per phase. Tests have been made in the shop to determine transient interference between welding stations. This was done by setting up an intermittent short circuit on unused welding stations, while an operator was at work on another station. This was in the nature of a surprise test, because the operator was not aware of the fact that a test was being made. At the conclusion of this test the operator was asked whether he had noticed anything peculiar in the behavior of his arc. The operator stated that he did not notice any unusual behavior and examination of the weld indicated nothing irregular in arc performance.

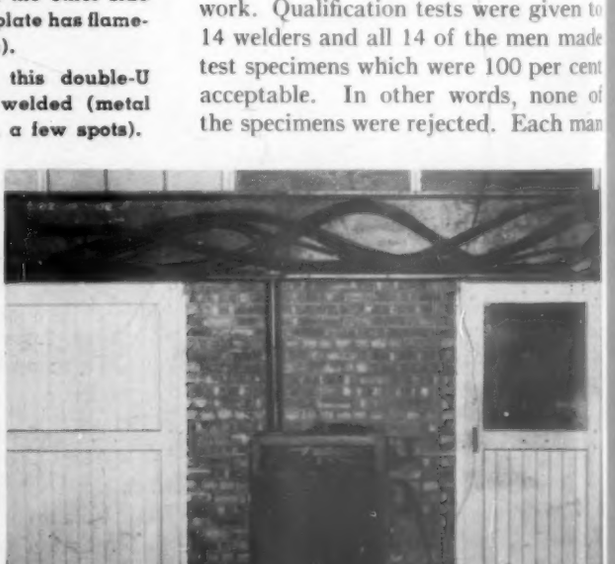
Left—What the underside of the double-groove looks like after the other side has been welded (left plate has flame-cut edge).

Right—Other side of this double-U butt joint has been welded (metal has fused through in a few spots).

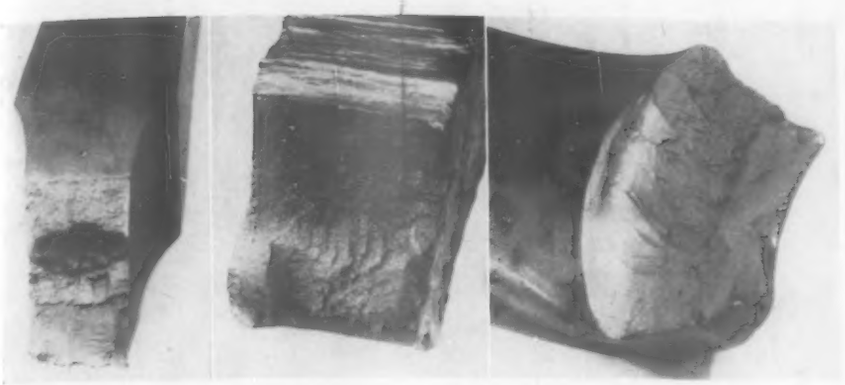
Each welding station comprises an auto-transformer with voltage taps and a reactance coil equipped with current taps, and a small hand wheel for obtaining fine variation of current in between the adjustment obtained by the current taps. It will be seen from one of the photographs that the operator has a voltage plug in the top panel and a current plug in the lower panel. The voltage is adjustable in steps of 5 volts from 60 to 80. The current is adjustable in the following steps: 60—150—250—400—600 amp. Current control between these tapped connections is obtained by turning the hand wheel at the base of the welding station. Rotation of the hand wheel changes the magnetic flux distribution in the reactance coil and permits the operator to regulate his current to the exact value he desires.

Test Specimens

In accordance with procedure set up in the A. S. M. E. code, Paragraph U-69, it was necessary to qualify the new process. Four specimens taken from 1½-in. butt-welded plates were prepared and sent to an independent testing laboratory. These were for determination of tensile strength and yield point. Specimens showed ultimate tensile strengths ranging from 70,000 psi. to 73,000 psi. Yield points ranged from 50,700 psi. to 54,200 psi. After the insurance company's approval was obtained on the process, it was necessary for Hamler Boiler and Tank Co. to qualify the operators which were to be employed on code work. Qualification tests were given to 14 welders and all 14 of the men made test specimens which were 100 per cent acceptable. In other words, none of the specimens were rejected. Each man



Heavy cables of 500,000 c.m. section distribute power to the welding stations. Note transposition of cables to reduce mutual inductance and transient interference between stations.



Physical test specimens prepared for qualification of welding process and welding operators. Dense grain structure is particularly apparent in the free bend specimen fracture at the upper extreme right.

was required to make up four coupons, two for nick-break test and two for free-bend test. It seems remarkable that some of these test coupons on the bend test showed elongations from 62 to 72 per cent. One welder, with less than 50 hours actual welding experience, made two test coupons, one showing 46 per cent elongation, the other 44 per cent. Minimum requirement to meet the operators' qualification test is 20 per cent elongation.

This new a-c. welding installation at Hamler Boiler & Tank Co. was engineered and manufactured by Electric Arc Cutting & Welding Co., Newark, N. J. Charles Clark, welding foreman of Hamler, is in charge of all welding and welding equipment as described in this article.

Circumferential and longitudinal welds in clarifier tanks built by Hamler. Note small amount of spatter along welded seam.

Welded All-Steel Corrugated Trailer Body

★ The advantages of welded, all-steel bodies for trailers and trucks have been demonstrated by the Trailer Co. of America, Cincinnati, O. in a corrugated body job. In production for nearly five years, the corrugated body design has proved to be practical in every respect. It is estimated that more than 10,000 of the jobs produced by the company's various branches are now on the road.

The corrugated body has several advantages. It is one of the lightest weight trailer bodies made without the use of alloy metals. It is unusually attractive in appearance and provides for maximum load space. Rigid construction, made possible by the welded design, practically eliminates body maintenance cost. The corrugations provide exceptional cargo protection in case of accident. Test wrecks on the corrugated bodies have proved that they will protect cargo against water, fire and breakage hazards.

Welding is used in several places at the rear of the body to provide exceptionally sturdy construction. The pressed steel header is welded to the corner posts. The all-metal doors are of rigid welded construction. Door hinges are welded to the heavy, all steel corner post. The tail gate chain ring is welded on in the direction of strain.

A rigid, non-weave frame is made possible by full-height members with integral gussets. The floor is fastened to wood sills bolted to cross bolsters. The extended front is a continuous part of the side rail. The king-pin and pickup plate are reinforced by heavy channel cross-braces, the pickup plate extending completely across the side rails. The continuous rub rail and floor angle prevents sagging of the body, the rub rail being one continuous piece of heavy channel steel around the entire body and frame. A sheet metal pan over all the wheels, under the floor, keeps water from the floor boards. If the customer desires, the entire floor can be underlaid with sheet metal, making the body a solid steel shell.

Heavy gauge, pressed steel corner posts are welded to the header and rub rails. To permit quick replacement of the side panel, it is riveted to the corner post. However, it is welded to the lower channel. The post is also welded to the outer rail and cross-bolster, providing a most rigid type of construction.

The side panels are strengthened by sharply formed, deep corrugations, each having the strength, but not the weight or the bulk of a heavy oak

(*Continued on page* 35.)

Welding the corrugated trailer body.

Double unit corrugated trailer bodies are completely arc welded.

The operator can do a better job if he is familiar with the best technique of arc welding.

First of a series
of practical lessons in

Technique of Arc Welding

★ Part 1—Types of welding power supply and heat regulation—Adjustment of machine—Running beads in flat position

By ROY OWENS

Welding Instructor, Electro-Motive Corp., LaGrange, Illinois

IT IS MY OBJECT in this series of educational articles to bring welders and apprentices a course in electric arc welding that will require a minimum of reading. The first and most important consideration is safety. Never look at the arc without a hand-shield or helmet. Gauntlet gloves and high top shoes should be worn. Trousers without cuffs are advisable. Do not have any part of the body exposed to arc rays as they will cause serious burns.

In arc welding two kinds of current may be used—alternating or direct. A-C. sets are generally of the transformer type which take current from an outside source and convert into welding current. This means that the current coming to the transformer is 220 volts and 40 or 50 amp. This voltage is reduced to 40 or 60 volts and the amperage is stepped up to the desired amount. On this type of machine there is usually one of three kinds of controls. (1) A series of knife switches graduated for different heat stages. (2) Sockets or plugs to obtain desired heat control. (3) Wheel or crank type, which, when turned in one direction, will increase the heat and when turned in the opposite direction will decrease the heat. This kind of welding current has the same heat value at both terminals, and since this is alternating current, the polarity at the electrode is constantly reversing.

Generator Characteristics

Arc welding requires a steady supply of electric power to develop the concentrated heat at the arc. By means of the arc, the tremendous amount of electrical energy is transformed into heat energy in a space no greater than that occupied by a rubber eraser on a lead pencil. This accounts for the extremely high temperatures built up at the tip of the electrode and at the surface of the base metal. The electric arc represents the highest concentration of electrical energy used in any industrial process. Arc voltage varies in operation from a minimum of 15 to a maximum of about 45 volts. Welding currents will vary from a minimum of 25 amperes on thin gauge material to a maximum of about 800 amperes on heavy slabs. Machine welding with the carbon arc may use currents in excess of 1000 amperes.

There are three distinct types of direct current welding generators in use today. In one type of machine the operator has control only of the open-circuit voltage. Referring to Fig. 2 it will be noted that the arc voltage rises to a maximum greater than the open-circuit voltage, then drops off suddenly as the arc length is diminished to welding proportions. This peculiar type of characteristic curve showing relationship between welding current and arc voltage is inherent in the design of the machine. What electrical engineers term "crossfield excitation" is employed to produce this type of output curve.

In another type of single-control generator, the operator varies the welding current by shifting a small hand wheel which changes the position of the brushes on the commutator. This change in brush position varies the excitation of the machine through the "armature reaction effect." In this machine the open-circuit voltage remains constant.

In the third type of welding generator, the operator has independent control of open-circut voltage and welding current. This design permits greater flexibility of control, but in general the characteristic curves at the arc voltages used in operation, have somewhat similar shapes. That is to say, the arc

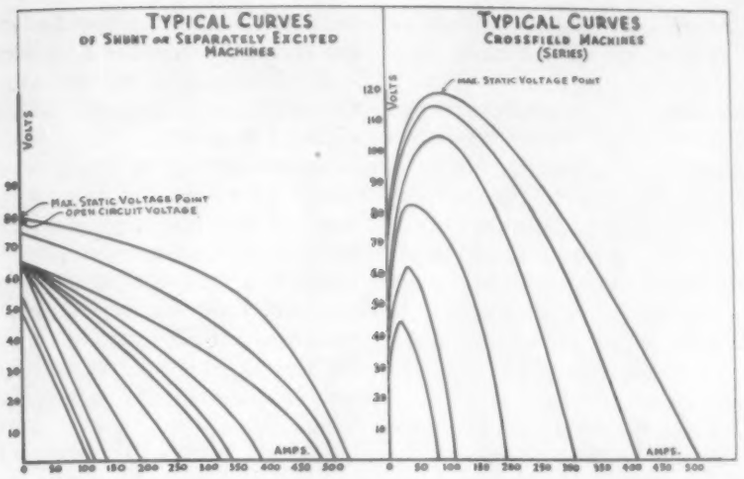


FIG. 1—(Left) Typical static volt-ampere curves such as can be obtained from dual-control welding generators.

FIG. 2—(Right) Typical static volt-ampere curves such as obtained from one type of single-control welding generator.

voltage falls off rapidly as arc length is shortened, but welding current increases with drop in voltage across the arc. In other words, the arc acts as though it had negative resistance. Ordinarily, according to Ohm's law, an increase in current means an increase in voltage drop across any portion of an electric circuit. However, with the electric arc, the resistance diminishes rapidly with increasing current and this accounts for the negative slope of the characteristic curve.

Where an A-C. transformer is used as a source of welding current, the voltage and current in the arc circuit vary in a manner quite similar to the characteristic curves shown in Fig. 1 for the dual-control D-C. machine.

Heat Generated

The heat generated in the arc is a product of the voltage across the arc and the current flowing through the arc. From research work on electric arc operation, it has been found that at least 50 per cent of this heat energy is generated at the surface of the electrode and at the surface of the base metal. In other words, there is a tremendous concentration at each end of the arc, which accounts for the extremely high temperature (up to 10,000 deg. F.). The steadiness of the arc depends primarily on the constancy of the power input to the arc; namely, volts times amperes.

D-C. welding machines have positive and negative terminals. When the electrode is connected to the negative terminal "straight" or standard polarity is used. This means that the current is flowing from the work to the electrode. By changing the lead or

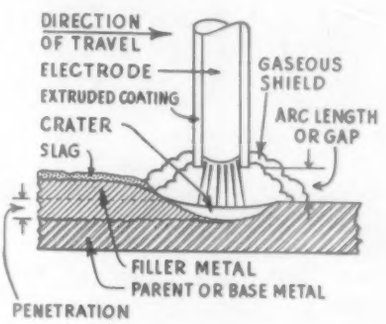


FIG. 3—Schematic diagram to indicate the essential elements of arc welding with a coated electrode.

polarity switch the current will flow in the opposite direction, from electrode to work. This is known as "reverse" polarity.

Some d-c. machines have a voltage control while others have a fixed voltage. The fixed voltage machine is set at the factory to give proper open-circuit voltage. On dual-control type, where the operator can adjust voltage and amperage separately, there are several things to be considered. If there is not enough voltage and too much amperage, a wild arc and excess spatter will result. When the controls are reversed a nice smooth arc may be obtained, but penetration may be sacrificed, or an arc held too long. Holding the end of the electrode farther from the work, than the rod diameter, may cause oxidization of the weld. In brief, this means if the rod is ¼-in. in diameter the electrode should also be ¼-in. from the work.

The foregoing instructions as to arc length are essentially true only for bare or processed electrodes. With shielded arc rods, it is best to follow the manufacturer's recommendations as to arc length.

Most modern welding machines are equipped with a polarity switch for reversing the flow of current without changing the lead cables at the terminals. Lead cables consist of two stranded copper insulated cables. One is for the connection to the electrode holder and the other for the ground plate to complete the circuit.

The ground cable is attached to the work and when the electrode is brought in contact with the work a circuit is completed and an arc is formed across the gap. Since this is the point of highest resistance in the circuit a tremendous amount of heat is developed at this point. This causes fusion by melting the parent metal (work) and the electrode. These metals fuse and form a perfect union.

Volts and Amperes

Amperage is often referred to as "heat" in arc welding, but without voltage an arc cannot be made. Voltage is the force that delivers the current or heat to the electrode and across the gap when the arc is made. The arc is composed of a series of minute metallic particles and ionized gases crossing the gap from positive to negative. By turning the voltage up (increasing) the particles are probably carried across the gap at a greater velocity and in greater number. This will increase the heat to a certain extent. On the dual-control welder, the heat is obtained by the amperage control switch. In setting a welder of this type, the volts should be set so as to give a smooth arc at the gap, then the amperage turned up until the desired penetration is obtained.

The first thing to learn is how to adjust the machine, strike an arc and run a straight bead. Then try connecting the beads where the old bead was stopped so that the connection cannot be determined and the weld appears to be one continuous bead. Prac-

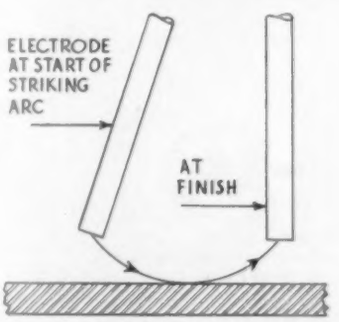


FIG. 4—Striking an arc is something akin to striking a match.

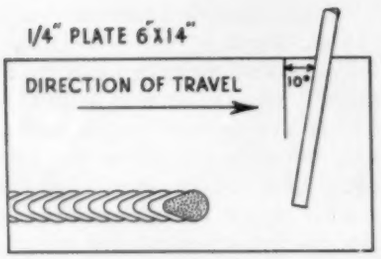


FIG. 5—Correct angle of electrode in laying a straight bead on flat plate.

tice this in the flat position using 1/8 in. and 5/32-in. electrodes and have the machine set for 125 amp. and 150 amp. respectively (using bare or light processed electrodes). If the electrode is moved too fast along the plate there will be very little metal deposited and practically no fusion or penetration will be obtained. A jerky or uneven motion will cause an irregular bead; therefore, keep in mind that a slow steady movement is essential.

Watch the metal build up to an even height and width and then try to maintain this the full length of the bead. Keep the electrode at the leading edge of the crater at all times. If the current is too low the welder can easily recognize this by the difficulty he has in striking and maintaining the arc. The electrode may freeze to the work, and can be loosened by a quick twist or side motion. If not freed immediately the electrode will become heated and will be difficult to remove except by loosening the electrode holder. Watch the depth of the crater as this indicates the amount of penetration.

How a Good Arc Sounds

If the arc is of the proper length it will give off a continuous snap or crackling sound and the metal passing from the electrode to the work will be dense and invisible. If the arc is of excessive length, it will have a hissing and sputtering sound and the metal will be visible as it passes from the electrode to the work. An arc of this type should never be used except for high carbon and hard-surfacing electrodes.

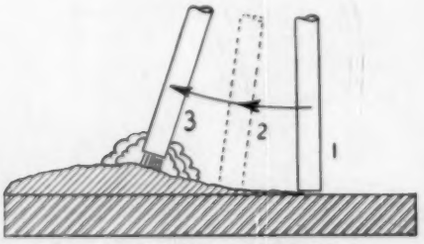


FIG. 6—Correct method of restarting the arc to make a good continuous bead.

In electric welding there are two kinds of electrodes used, the carbon and metallic. The first mentioned is only to supply heat to the work. A filler rod is added to the molten crater to provide the necessary metal. As the metallic electrode is more universally used, these lessons will be confined to the metallic type. The metallic electrode has certain advantages over the carbon type.

(1) The filler metal is added as the electrode is melted.

(2) The amount of filler metal can be regulated by the speed at which the operator moves the electrode.

(3) The heat setting and manipulation of the arc will govern the amount of metal deposited.

Before starting to weld, the metal should be thoroughly cleaned with a wire scratch brush, grinder or sand blast. Before the operator should even attempt to weld over an old bead, all slag and scale should be completely removed. Welding on oily or painted surfaces is very difficult and a hard and brittle weld will usually be obtained.

(Second lesson in Mr. Owen's series will be published next month.—*Ed.*)

Low-Current Welding of Thin Sheet Metal

By J. W. ALLISON*

★ The statement is sometimes made that high voltage and low current are needed for light-gauge welding. Actually, it is not the high voltage that is needed on thin sheets, but the small current variation while welding. What is desirable, then, is steepness of the volt-ampere curve. Steepness of the characteristic curve and small current variation go hand in hand. With the same steepness, a single-control welding machine will weld equally as well as a dual-control machine. A discussion of the fundamental factors involved may help to clarify the meaning of high voltage as applied to welding of light-gauge materials.

Let us take a look at what the arc does. While welding, the arc-voltage will vary five or more volts above and below the true arc-voltage, for a given electrode diameter and parent metal. When welding at 50 amp. with a 20-volt arc, the voltmeter needle dances between 15 and 25 volts, because the molten part of the electrode does not go across the arc at a constant rate of transfer. The little globules are not flowing at a constant number per second.

Therefore, when the arc gap or stream is fairly dense with globules the arc drop is low. The voltmeter reads 15. Likewise, when the arc stream contains relatively fewer number of globules the arc drop is high. The voltmeter reads 25. In other words, the more globules in the arc stream, the nearer the arc stream approaches a continuous metallic conductor or short circuit. The voltmeter goes from 15 to 25 and vice-versa many times per second. At short circuit the voltmeter reads 5 to 10 volts, depending upon the resistance drop of the welding leads and parent metal.

Now as the voltage of the arc varies —the welding machine automatically

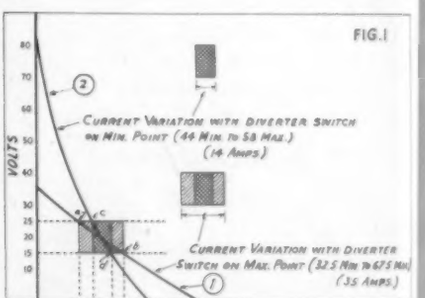


FIG.1
VOLTS
CURRENT VARIATION WITH DIVERTER SWITCH ON MIN. POINT (44 MIN. TO 58 MAX.) (14 AMPS.)
CURRENT VARIATION WITH DIVERTER SWITCH ON MAX. POINT (32.5 MIN. TO 67.5 MIN.) (35 AMPS.)
WELDING AMPS

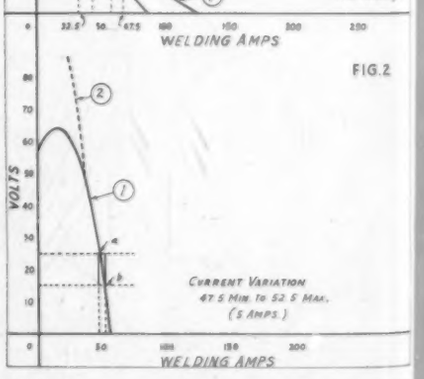


FIG. 1—Welding current variation using either a flat or rather steep volt-ampere curve (dual-control machine).

FIG. 2—Small current variation with steep curve obtained from a single-control welding generator.

* Industrial Division of Westinghouse Electric & Mfg. Co., Philadelphia, Pa.

varies the welding current. The flatter the volt-ampere curve—the greater the current variation. For example, Fig. 1, Curve 1 is typical of a dual-control machine with the diverter switch set on maximum and the rheostat set to give 50 amp. at 20 arc-volts.

When the voltmeter reads 15 (point "*b*") the current automatically increases to 67.5 amp., which is much too hot if 50 amp. is the right current and all that the operator needs. The penetration is too deep, or metal is "burnt", or a hole is "knocked" through every few linear inches of weld.

When the voltmeter reads 25 (point "*a*") the current automatically decreases to 32.5 amp., which is much too low if 50 amp. is the right heat. The penetration will be too shallow and the arc will go out frequently. It goes out because there is not enough heat to melt the end of the electrode, the parent metal and keep the gap ionized.

Now, in using dual-control machines, the operator throws the switch to the minimum point which changes the characteristic of the welding generator to high voltage as indicated by Fig. 1, Curve 2. Again, the rheostat is set to give 50 amp. at 20 arc-volts. With this setting the open circuit or no-load voltage is 85.

When the voltmeter reads 25 (point "*c*") the current automatically decreases to 44 amp. That current is not too low. The penetration is sufficient and the arc does not go out.

When the voltmeter reads 15 (point "*d*") the current automatically increases to 58 amp. That is not too much heat or too much penetration. No holes are "knocked" through.

Steepness of Curve

From Fig. 1, Curves 1 and 2, it is not the high voltage that makes it easy to weld light gauge, but small current variation while welding. A voltage a few volts higher than the maximum required by the arc gap is all that is necessary. What is really important is steepness of the volt-ampere curve.

A single-control machine with the same steepness of volt-ampere curve, or the same current variation, will weld equally as well as a dual control. The single-control machine eliminates the overlapping of the minimum, medium and maximum points so that the operator does not have to worry whether to go and change from medium to minimum. If the need for changing is on the border line, probably more often than not, the "diverter switch" is not changed. On the medium point, the speed of welding is slower and the spatter is greater than need be.

The smaller the current variation, the easier it is to weld. With more speed and less spatter, we get better weld metal. In Fig. 2, Curve 1, the current only varies 5 amp. which makes it easier to weld light gauge material. With this design we can think in terms of high voltage, even though the open circuit, or no-load voltage is below 60. This single-point generator design turns all the volt-ampere curves over and back to a lower and safe voltage, descending to a no-load voltage of 30 to 80 depending upon the setting for welding current.

Welding Applications on the Golf Course

★ Claude Holslag, well known exponent of arc welding, of the Electric Arc Welding & Cutting Co., Newark, N. J., has come forward with some interesting suggestions for the use of the welding process on the golf course.

There probably isn't a golf course in existence that doesn't have need for bridges or steps over those ever-present hazards. Mr. Holslag has turned his ingenious mind to an application of welding which would solve the difficulty of recurrent replacement and repair of such necessities. Figure 1 shows Mr. Holslag and a group of friends on a bridge which he designed and had installed on the course where he regularly breaks par or takes a shot at it.

The construction is really simple when it is examined. One 8 x 8 in. angle is welded to each of the abutments. Two 40-ft. 8-in. I beams are then placed in position and allowed to sag their normal amount. A stiffener is welded across the bottom in this sag position after which the unit is turned upside down where it will straighten out in perfect alignment. There is never any possibility of rotting or sagging as is usual in ordinary timber construction. Mr. Holslag has generously abstained from patenting his design, making it possible for all golf courses the country over to take advantage of his attractive and money-saving idea. He goes further and offers to design any bridge or special welding installation for any job welding shop without charge of any kind.

Directional Signs

Another of his many ideas is for the making of special directional signs, etc., which are used widely in keeping golf bugs on the right track. Figure 2 shows one of these specials of ⅛-in. plate. A single bead arc deposit is used to make the necessary letters. The raised deposit is then painted white over a black background or other desired color combination. Prongs can be welded to the sign for sticking in the ground or clips for attaching to post or fence.

FIG. 1

Claude Holslag is shown standing on the welded bridge of his own design—He will help anyone design a similar type of bridge—This golf course is not in Miami, Fla.

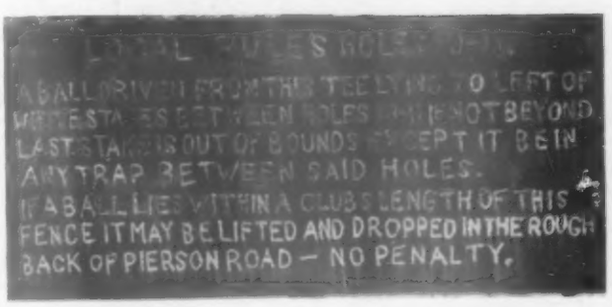

A BALL DRIVEN FROM THIS TEE LYING TO LEFT OF
AND NOT BEYOND
LAST STAKE IS OUT OF BOUNDS EXCEPT IT BE IN
ANY TRAP BETWEEN SAID HOLES.
IF A BALL LIES WITHIN A CLUBS LENGTH OF THIS
FENCE IT MAY BE LIFTED AND DROPPED IN THE ROUGH
BACK OF PIERSON ROAD — NO PENALTY.

FIG. 2—Directional sign for golfers made of a single bead arc deposit on ⅛ in. plate.

Welding—Major Tool of Industry

Suggested Rolled Steel Shapes for Fabrication

By A. M. MACFARLAND*

★ The fabrication of structural shapes by welding is now so extensively conducted, that a large tonnage of steel shapes and plates is required to supply the base materials. The manufacturers of such steel have not been unmindful of this source of revenue, and have done their part to develop weldable steels. However, it is the writer's opinion that the time has arrived for the steel manufacturers to make a study of the possibilities of a potential market for new shapes to meet the needs of the welding art.

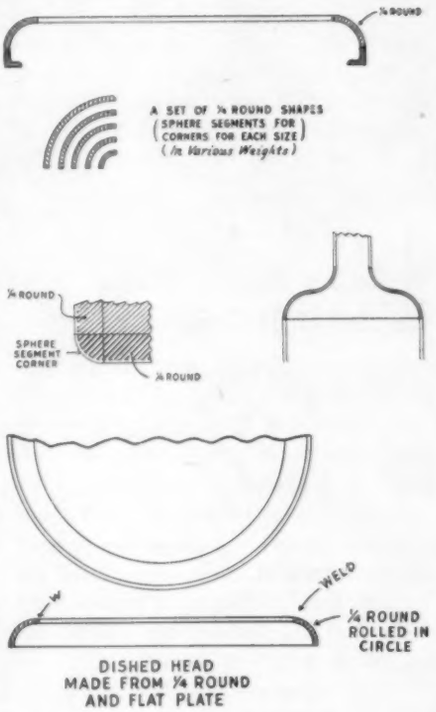
The present line of angles, channels, etc., was developed for structural needs as based upon riveted construction.

There is certainly sufficient demand for a line of such shapes, to make a profitable business for some steel company to shape up the necessary rolls, etc. Of course, it would not be necessary for every steel company to manufacture or stock a full line of such shapes.

Steel foundries have been solicited to cooperate with welding shops to work out standard combinations of steel castings, welded to structural shapes or plates, and have been holding up active work along these lines until business improved enough to pay a profit on steel castings.

Such items as a cast hub and spoke spider, to be welded to a rim of rolled steel bar for a gear wheel, or a cast frame for a water-cooled open hearth door, to be faced with steel plate, or cast frames for machines, to be combined with welded plate faces, offer attractive possibilities. A steel casting is less ductile than a rolled plate section, and if the steel manufacturers will cooperate with the welding shops, they may obtain a share of this business which otherwise may go to the steel foundries.

Some sample rolled steel shapes are sketched, together with some suggested applications. The shapes shown are


¼ ROUND
A SET OF ¼ ROUND SHAPES
(SPHERE SEGMENTS FOR CORNERS FOR EACH SIZE)
(In Various Weights)
¼ ROUND
SPHERE SEGMENT CORNER
¼ ROUND
WELD
¼ ROUND ROLLED IN CIRCLE
DISHED HEAD MADE FROM ¼ ROUND AND FLAT PLATE

Suggested rolled steel shapes which would simplify and enhance the beauty of welded structures.

merely samples to convey the idea. It is proposed and suggested that study be given to a line of shapes for welding purposes, as comprehensive as the line worked out for riveted construction. This would include clips and hangers for pre-welded and fabricated parts for house frames, ready to erect on the job.

Little or no development of new shapes to meet changed conditions has been undertaken. Those pioneers in fabricated and welded shapes, who have progressed beyond round and square tanks and boxes, have been obliged to supply their own shaping appliances, and many of them have been very ingenious at it. In making up such items as machine bases, or frames, however, square corners seem to be necessary. It has been said that a welded frame may be as strong as a steel casting, but the average sample of such construction has a rough "home-made" appearance, entirely out of keeping with the advancement in the art of welding*.

Without expensive presses and forms it is difficult to make neatly rounded corners in fabricated steel construction made from plate and angles. If a supply of rounded corner bars, sphere quadrants, etc., was available, such shapes could be combined with flat plate to make up frames, bases, etc., having a neater appearance, without any loss of utility or strength.

*Welding and Production Engineer, Freeport, Ill.

*Reader, please refer to J. H. Cooper's article, "Welded Machine Fabrication In Step With Styling," page 55, September, 1937, issue of *The Welding Engineer*.

Welding Builds Auto Transport Trailer

★ The accompanying photo shows one way in which welding has contributed to the trucking industry. The job comprises a truck body and trailer for transporting new automobiles to dealres and distributors throughout California. The unit, which carries five cars, was designed and built by G. B. Tanner, proprietor of the Nelson Welding Works, of Bell, Calif. and is 100 per cent welded throughout.

Welded transport trailer can handle five cars.

The main longitudinal members of the frame are of 7-in. pressed steel channels. Six-foot and three-foot upright members support the framework which carries the overhead cars. The truck and trailer has an overall length of 59 ft. 10 in., the truck being 26 ft., 11 in., and the trailer 32 ft., 11 in. Welding also provided means for a 6 ft. extension to the trailer which was added after the original unit was built, giving capacity for one additional car, as can be noted.

Other welded features of the unit include an all-welded fifth wheel and welded fenders, which are of 16 gauge sheet steel. There is not a rivet in the entire job.

Japanese A-C. Arc Welder

By H. LEOPOLD

★ It is claimed that the superposition of high-frequency power in a welding current improves arc stability, lowering the secondary no-load voltage of the welding transformer, therefore rendering it possible to enlarge application of A-C. arc welding, especially in thin plate welding without risk of electric shocks. This statement is made by T. Ogawa in a recent issue of the "Hitachi Hyoron," Tokyo.

But, by the usual method the high-frequency power is used continuously, so that the spark gap of the oscillating circuit gradually wears away with increased high-frequency circuit voltage. Moreover, since the high-frequency high voltage is always alive, even at non-welding current, its effects are not only unpleasant but may be dangerous.

In a new Japanese designed welder, the starting and stopping of the high-frequency power are followed and controlled automatically by the main welding current, the arc stability being absolutely equal to that method in which high-frequency power is used continuously. Furthermore, the source of the high-frequency circuit can be opened and closed by an automatic relay. The exciting coil of this relay is connected in series to secondary and tertiary windings that are connected in series. Now, if at no load, both windings have equal and opposite phase voltages, the series connection of the two windings gives no current to the exciting coil of the relay.

But the tertiary winding is magnetically coupled to the primary intimately and a secondary winding coupled roughly to the primary. Since at the loaded condition, the secondary voltage always drops to the arc voltage and an unbalanced current flows into the exciting coil of the relay, the vector sum of the secondary and tertiary voltages assumes zero value, or a certain constant value with respect to the no-load or loaded condition of the main welding circuit.

The relay operations follow exactly the load change. Next, the arc stability is greatly improved by the distinctive feature that the high-frequency oscillating circuit is opened with a certain time lag with respect to the welding current by the automatic relay construction, both mechanically and electrically.

If the high-frequency current were to become zero the moment the arc is cut off at the welding process, the arc would become very unstable, because restart of the A-C. arc is very difficult through lack of ionization. Consequently, the high-frequency current should be instantly superposed at the start of the welding current, and in stopping, it should be made to last a few cycles longer than the welding current in order to render the next starting easy and to constantly maintain a stable arc. For these purposes, it is necessary to give the controlling device for the high-frequency oscillator a quick and accurate pull on starting and to obtain a definite time lag with respect to the welding current.

The welding transformer should be designed for very low secondary voltage owing to good stability of arc, so that the efficiency, power factor, and the primary input kva. may be greatly improved. It is claimed that stability of the arc is such that mild steel of 1 mm. thickness can be A-C. welded with a bare electrode of 1 mm. even by an unfamiliar operator.

Diesel Engine Welding Repair Saved $16,000

By J. C. COYLE

★ Running night and day for three years, three "walking type" draglines, excavating the All-American and Gila Valley (Calif.) irrigation canals, have proved that heavy welding can "take it." These huge 680-ton veterans bear many welded scars from this and previous jobs. The 175-ft. boom, with 16-yd. bucket on the end, is never still except for oiling or repair. Parts of these machines are naturally huge and, working as they do from supply centers, heavy welding repairs are part of the regular routine.

As one of these big draglines finished a particularly hard section of rock excavation, the cast iron sub-base of the 450-hp. diesel engine was found to be cracked. Five 2½-in. vertical braces inside the casting had broken loose at the bottom, causing a horizontal crack 27 in. long in the front wall. The nature of the breaks seemed to make replacement, at an estimated cost of about $18,000, the only recourse. However, a careful study of the problem led to repair by a combination of machine work and welding. The cost was in the neighborhood of $2,000. Welding thus saved the contractor $16,000.

Obviously, the interior breaks could not be reached with standard welding equipment, but preliminary study demonstrated that specially devised electrode holders, and other deviations from regular procedure would solve the problem. The cylinder base was removed and all openings to the interior of the casting were covered, some of them on a level with the broken braces, others below. Cylinder stud holes penetrated 3½ in. into the top of the sub-base. (Refer to Fig. 1). These were drilled and tapped, breaking off the cracked braces and extending the holes through the bottom of the casting. Five 2¼-in. nickel steel threaded bolts were made, to take the place of the cylinder studs. They were designed to screw into a thimble section, 4½ in. in diameter and 7¾ in. long, 2¼ in. of which was turned down and threaded to enter the 2¼-in. hole in the casting bottom, as shown in Fig. 1.

Repair Studs and Thimbles

The thimbles were installed through the side holes of the casting, the bottom end of the 4½ in. thimble screwing into a 1 in. by 8 in. machined nut, attached to the casting bottom with four ⅞-in. cap screws, and later welded. (Fig. 3). A 2-in. by 6-7/16 in. spanner nut was started on 2½ in. of tapered threads at the hollow end of the thimble. The 23⅛ in. threaded bolt was then screwed down to a jam fit 3½ in., in the thimble and the assembly tightened with a spanner wrench (Fig. 2). Four 1/8 in. radial slots, 3 in. deep on the outside and

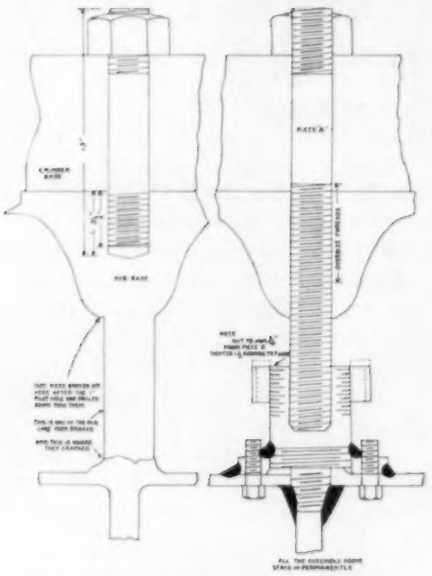


FIG. 1—How the repair studs and thimbles were used to effect the welded repair of the cast-iron sub-base. The fillet welds are indicated in solid black.

3½ in. on the inside, of the hollow end, allowed the spanner nut to close the threads and prevent loosening of the studs by vibration. If necessary the studs can be removed by loosening the spanner nuts.

When making the repair studs and thimbles there was some question at first about making the threads match at the different points of contact, along the 27-3/8 in. combined length of the two assembled pieces. This was accomplished by first placing the straight stud between centers in a lathe and cutting all threads, which are oversize where the stud is screwed in the casting. The blank for the thimble was first drilled and threaded internally for the jam fit with the stud, then centered and the stud turned down. The two parts were then assembled and the opposite centers used to suspend them in the lathe, while the stud end and 1 in. of the main thimble were threaded with the threading tool set by the threads on the stud bolt. The assembly was then turned around and the taper threads cut and the radial slots made in the hollow end.

Special Drilling Frame

Special equipment was required in preparing for installation of the repair studs. To properly align the two sections of each hole, at the top and the bottom of the casting, a 1-in. pilot hole was drilled, then enlarged to 2 in. and tapped out for the 2¼-in. stud. The drills were attached by a taper joint, tack welded with bronze to extensions of cold rolled steel of the same size. Drills and motor were mounted in a special frame. The tap was made from a 6-in. section of tool steel, with slightly over-sized threads to clean its way through the 3½ in. of hole from which the cylinder studs had been removed. It was also given extra taper to fit the 2 in. drilled hole. It was turned by a hand lever and was guided by a 30-in. section of common shafting, threaded and attached to the tap with a taper and then welded.

When drilling the pilot hole, the 1 in. drill fit snugly inside a 2¼ in. hollow sleeve, 9 in. long, threaded on the outside and screwed into the original 3½-in. hole at the top of the casting. It extended up through the hole in the base of the frame, and was removed in enlarging the holes. Each cracked brace was broken off at the top of the 2½ in. circumference, as the 2 in. drill reached that point. The drill was then extended to the bottom section of the hole. Before the holes were threaded, a 1-in. extension grinder shaft was passed through each hole and attached to the motor with a taper. A nut with right hand threads and a small collar with left hand threads, were used to attach the grinder from below. It was then used in smoothing up the base

FIG. 2—How the long threaded bolt appeared after being screwed down to a jam fit into the thimble, using a spanner wrench.

FIG. 3—Looking through a port-hole at a 4½ in. thimble screwed into a 1 in. by 8 in. circular nut fastened, to the casting shelf by four cap screws, and later welded as shown in Fig. 1.

for the studs, and the rough broken edges around the hole at the top.

How Welding Was Handled

Doors and windows were closed, and a canvas stretched above the casting. It was then pre-heated to approximately 100-deg. F. with four portable heaters, which were moved every 45 min., a check being kept on the temperature by means of four thermometers, about evenly spaced on the casting. A chart was prepared by the welder, and on this the men assigned to pre-heating recorded the thermometer readings every half hour. Eight hours were required to bring up the temperature. After the welder and his helper began work, in 8-hr. shifts, the temperature was raised to 103 deg. F. during the night, by the pre-heat man.

Difficulty of Welding

Most of the welding was overhead work, which required extreme care in placing the metal. Some welds were made in such close places that only about 1½ in. of electrode could be used at a time. In one instance the welder managed the electrode through a 1-in. hole, while watching his work through a similar hole around a corner in the casting. To reach all of the interior welding it was necessary to improvise two special electrode holders, one 4 in. the other 20 in. long. These were made from ⅛-in. pipe, carefully insulated with tape and with the whip cable attached to one end. The electrode was wedged in the other end with a short bit of sharp rod, and the resulting bare place insulated with a section of acetylene hose.

Holding the 20-in. electrode holder

FIG. 4—Using a 20-in. special electrode holder to weld inside of the casting. Note thermometer to check preheating temperature.

in gloved hands the welder could reach part of the interior welds from a position above the casting, working through small openings at the top. The surface of the casting had been ground smooth for the thimble, and the broken edges chipped off at top and bottom with a chipping gun, and ground off. The surfaces were swabbed with a chemical and then wiped off before welding, to fill the minute pinholes which are apt to occur in cast iron. Welds were brushed and peened lightly about every third electrode, using a special ¾-in. tool, 24 in. long, in the air gun. Frequent moves kept the welds from getting too hot. While doing the interior welding, the helper held the ground contact clear, making or breaking contact when signaled by the welder's head movements.

Some of the welds could only be reached with the 4 in. holder. The thimbles were welded to the nut and cap screws at the bottom ends. The nut was welded to the casting bottom and the stub end of the thimble welded from below, where it projected through.

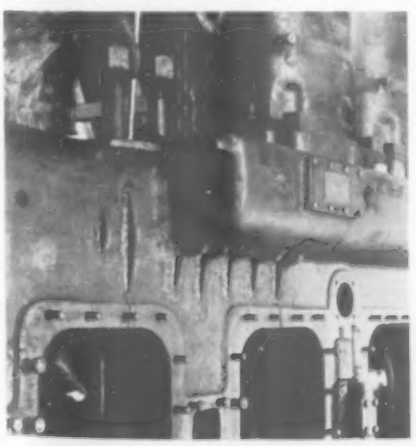


FIG. 5—Completed repair on the 27-in. horizontal crack in the casting wall.

Repairing the Cracked Casting

The 27-in. crack in the casting wall, which was about 1½ in. thick, was vee'd out with the chipping gun, at about 90 deg., to within ⅛ in. of the inner face. Edges of the crack were then drilled and tapped for 116, ¼ in. round iron studs, in stagger formation. These were screwed in place to form roots for the weld. The metal was then swabbed with the chemical and the weld brought up, brushing and peening as on the other beads. Seven mild steel ribs were cut and shaped from 1-in. plate, with a cutting torch, then ground and welded in place across the crack.

On completion of welding the casting its temperature was raised, over a period of four hours, to 106 deg. F. and held there for 6 hours, moving the stoves as indicated by the thermometers. The stoves were then removed and the work cooled slowly over a period of 16 hrs., checking the temperature every 30 min. This welding job required about 70 man hours.

Welded Trucks Speed Soft Drink Deliveries

★ Dr. Pepper used to make his rounds in a truck built of wood but things are different today! Now Dr. Pepper makes his calls in 90 new trucks, the bodies of which are constructed of arc welded steel. According to the General Body Mfg. Co., of Kansas City, Mo., welding has added to the attractiveness of their bodies, has made them more rigid and has enabled them to reduce dead weight thus providing greater pay load. The company also reports that the savings in time and labor made possible with welding paid the cost of the welding equipment the first three months of operation.

The shielded arc process was employed, using equipment supplied by The Lincoln Electric Co., Cleveland, Ohio.

Part of a fleet of arc welded steel delivery trucks serving a soft-drink manufacturer.

Welded All-Steel Corrugated Trailer Body

(*Continued from page 27*)

post. The wide overlap at the panel joints keeps out water. The indentation formed by the corrugation is filled flush with a wood filler, solidly bolted in place so that slats or plywood lining can be installed.

Roof ribs are die formed without cutting out notches in the metal, making them rigid and waterproof and eliminating ribs or struts inside the body which would interfere with the load. The roof is continuously welded to the top angle, eliminating the necessity for leaky bolt or screw holes in the metal. Since the roof is fastened to the top angle rather than the rub rail, a bump on the rub rail does not damage the top. The roof is not bent over the top angle iron. All roof joints are double lapped, then heavily soldered. Since the welded construction provides perfect rigidity, eliminating sway, the joints do not break open and permit leakage.

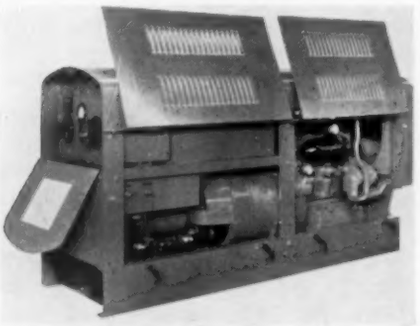
The rub rail itself is one continuous piece of channel steel, tack welded so that it is easily removed. Side panels are continuously welded to the rub rail, making them weather proof, yet easily removed for replacement. Tack welds at the floor angle make the joints tight and rigid. The channel shaped cross member is also welded to the rub rail, the clip angle providing for a non-weave, rigid union. The floor itself is screwed to the wood bolster block.

The rear cross member or bumper across the back end of the body is doubly protected by a flat gusset welded in the corner and a channel steel brace. Thus, the frame and bumper are held firmly in place. Electric welding is used throughout.

New Product Developments

Diesel Engine Drive Used for Arc Welder

★ A new diesel engine, which differs radically from the popular conception of this type of power, in that it compares favorably with gasoline engines in simplicity, weight and cost, as well, as operating speed, has been adopted for driving arc welding generators by engineers of The Lincoln Electric Co., Cleveland, Ohio. Development of this new engine brings the economy of diesel operation to all applications of welding requiring engine driven arc welding generators.



New 300-amp. diesel engine driven arc welding set, recently placed on the market by The Lincoln Electric Co.

The new diesel driven welder, shown in the illustration, is the result of research and testing to develop a power plant of correct design and construction to meet requirements of welding service.

This new Lincoln welder it is claimed will cut fuel costs 33% to 86%, depending upon the price of fuel oil used. For instance, at full load operation, it uses only 1.5 gallons of fuel oil per hour as compared to 2¾ gallons of gasoline per hour required for the conventional gasoline engine driven welder. In many cases, total savings including such items as transportation of fuel, loss, etc., are said to be as high as 40 cents per hour.

Maximum efficiency and service economy of the engine are assured by a new diesel principle embodying patented combustion chambers. By accelerating turbulence of the fuel and air mixture, this scientific device affords more complete combustion, increasing efficiency, and minimizing smoke and noise. Also, the position of this combustion chamber, relative to the piston, provides uniformly distributed pressure on the piston.

Other engine features include: pintle type fuel nozzles which are non-clogging and non-enlarging, assuring positive and uniform action; five filters (three fuel oil filters, one oil type air filter and one lubricating oil filter) contribute to the efficiency and dependability of the engine; use of the required number of standard 6-volt automobile batteries for starting facilitates field service and replacement. Through a standard relay the exciter charges the batteries. The main welding generator is used to start the engine. The engine is a compact unit without extras such as a starter motor, generator, special controls, etc.

The arc welding generator used on the new diesel engine driven welding machine, is the 300-amp. "Shield-Arc SAE" unit equipped with dual-continuous control, which provides the right size and type of arc for every application. Features of this generator include continuous voltage control; continuous current control; extra wide range; independent excitation; laminated magnetic circuit; high capacity; high efficiency; cool operation; all-purpose meter; and other features which experience has shown are necessary to ease of operation, proper performance and maximum welding economy.

The price of the new diesel engine driven welder compares favorably with that of gasoline driven arc welding sets.

Fast Acting, Non-Toxic Hard Soldering Flux

★ An improved, quick-acting hard soldering and brazing flux, Kwikflux, has been recently developed and is now being marketed, according to its makers, Special Chemicals Corp., 30 Irving Place, New York City.

Because of its low melting point, which is said to be below that of most hard solders now on the market, Kwikflux does not limit the speed of brazing and hard soldering operations, and allows the operator to perform his work as soon as the solder starts flowing.

The fluxing action of this flux begins at 212 deg. F. It has a flowing point from 78 deg. F. to 1600 deg. F., and over. Because it does not evaporate at high temperatures, and has a low vapor tension, maintaining its volume at high temperature, this flux can be used efficiently for high melting point solders.

Kwikflux is for use in hard soldering, brazing, or welding of stainless steel, steel, iron, copper, brass, bronze, platinum, silver, monel metal, German silver, and other metals and alloys, ferrous or non-ferrous, or any combination of these metals and alloys.

Its makers claim that Kwikflux cleans and floats away from the metal surface, the oxides and other foreign matter present; acts as a solvent for the metal oxides formed by the action of the air; and covers the brightened metal surface to exclude air. The excess flux washes off easily from the finished work, leaving no residue, thus saving time, and cleaning expense. The flux comes in the form of a paste which is to be mixed with water before using.

Kwikflux has no adverse toxic action, it is said, and will not injure the workers' eyes, skin and respiratory membranes, according to the manufacturer.

Goodrich Duoweld Oxy-Acetylene Hose

★ A new oxy-acetylene hose, known as Duoweld, has been announced by The B. F. Goodrich Co., Akron, Ohio. It consists of two strands of ¼ in. 2-braid hose with corrugated cover which are molded together as a single unit. The cover on one strand is red, while the other is green. This color distinction is adopted as an aid to the operator in identifying the acetylene

Duoweld oxy-acetylene hose eliminates kinking.

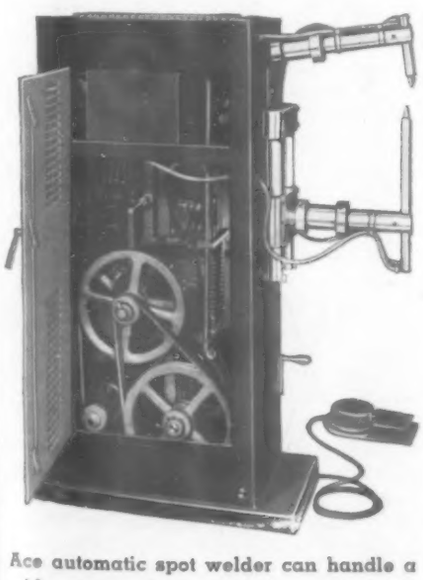
and oxygen lines. Advantages claimed for this dual construction are that it prevents the two lengths of hose from becoming tangled with each other; eliminates kinking and is less apt to snag on surrounding objects.

Goodrich Duoweld hose is offered in 12½-ft., 25-ft. and 50-ft. lengths. Each length is separated and secured with metal ferrules about a foot and a half from the ends for easy attachment to equipment.

Ace Motor-Driven Automatic Spot Welders

★ Automatic spot welders recently announced by the Pier Equipment Mfg. Co., 814 Cross St., Benton Harbor, Mich., accomplish increased output and decreased effort in control of operation. They provide control over the welding variables essential to efficient, uniform production. They have many features, including a vari-speed transmission having a 3 to 1 ratio of speed variation, mechanical weld timing control whereby welding time can be set as fast as 1½ cycles or 1/40 of a second; and precision of pressure application.

A unique feature of these welders is the power drive, a self-contained unit, consisting essentially of the motor, vari-speed drive, double reduction V-belt drive, pin-type clutch and magnetic clutch trip. The clutch is actuated through a magnetic unit controlled by foot switch which is attached to a flexible rubber-covered cable which can be placed in any convenient position, thus leaving the operator's hands free to handle the work.



Ace automatic spot welder can handle a wide range of gauges—Has adjustable speed power drive.

The speed of operation is adjusted through a convenient crank extending through the lower front part of the welder, which adjusts the vari-speed transmission. The standard units are made for speeds from 40 to 120 strokes per min. High speeds are available on special order. Connecting rod has provisions for adjusting length of stroke to 1 in., 1½ in., and 2 in.

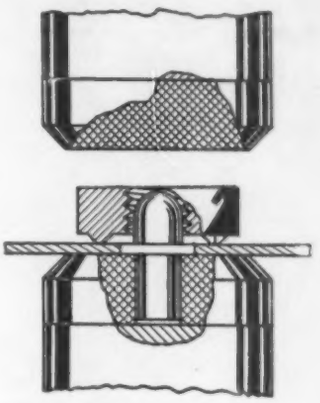
These welders are made in four sizes, namely 15, 20, 30 and 50 kva. A desirable feature is the wide range of gauges and materials that can be welded. Materials as light as .005 in. can be welded with the same size welder that will also handle up to two thicknesses of No. 8 gauge stock.

Detailed information and prices may be had by addressing an inquiry direct to the manufacturer.

Special Nuts Developed for Projection Welding

★ In response to a demand for an inexpensive method of fastening sheet metal products, The Ohio Nut & Bolt Co., Berea, Ohio, has introduced a special nut with four projections for resistance welding. This new type of nut is a companion to the line of welding bolts introduced by the same company a few years ago. The Ohio welding nut has four welding points or projections which are all of uniform height, thereby, insuring satisfactory flow of electric current through the points of contact, and the welding points are so spaced as to obviate any difficulty in setting up the necessary electrodes on the welding machines, or any difficulty from molten metal splashing into the threads.

Experience has shown that the time required for welding these nuts to a sheet metal surface is practically instantaneous. In many cases, using a standard 60 cycle current, the actual time of welding is equal to only two of three cycles. There is a saving in the cost compared to brazing. Furthermore, the nuts may be attached in places where brazing is said to be impracticable. It is not advisable to try to weld these nuts to surfaces that are plated or enameled. Such finishes should be applied after the welding process.



Method of positioning nuts in relation to welding electrodes.

In designing metal appliances these nuts open up many new fields. For example, welding nuts may be applied in the internal parts of gas meters for the purpose of hanging or assembling brackets or other parts without incurring any danger of leakage through the metal shell of the meter. The same advantages arise in manufacturing electric transformers for outdoor use, and many other products such as electric refrigerators and storage tanks. In many cases these nuts may be welded to sheet metal and eliminate the use of costly forgings and castings. They may not only be used for attaching threaded parts, but the blank nuts can provide bearings of the collar type for shafts or push rods.

Ohio patented welding nuts have been in use for over a year in assembling metal products, ranging from steel furniture to stoves, radios, automobiles and locomotives. The welding nuts have reduced costs and brought about improvements in design. They are now available on a production basis in sizes up to and including 3/8 in. and should the demand develop, they will be available in 7/16 in. and ½ in. sizes later this year.

CORRECTION—A typographical error in the Steel Sales Corp. advertisement in the March issue (page 45) credits Amsco No. 217, a hard surfacing electrode, with wear resisting qualities up to 100 deg. F. It should have read 1,000 deg. F., the temperature at which a weld deposit of this material will maintain its wear resisting properties.

News of the Industry

THE ASSOCIATION OF IRON AND STEEL ENGINEERS will hold its annual Spring Conference in Baltimore, Md., April 28th and 29th, with headquarters at the Lord Baltimore Hotel. L. F. COFFIN, superintendent of the mechanical department, Bethlehem Steel Co., Sparrows Point, Md., will be general chairman of the program. Mr. Coffin is also president of the Association of Iron and Steel Engineers. F. O. SCHNURE, electrical superintendent of the Bethlehem Steel Co., Sparrows Point, Md., will be general chairman of the arrangements committee. Over a thousand steel mill executives and operating engineers are expected to take part in the proceedings.

A. W. S. SELECTS GROUP TO AWARD LINCOLN GOLD MEDAL

A board of awards, composed of H. L. WHITTENMORE, chairman, and G. T. HORTON and A. G. OEHLER, has been appointed by the executive committee of the American Welding Society, to have charge of selecting the recipient of the Lincoln Gold Medal for 1938. Following appointment, the board drafted the regulations governing award of the medal. The purpose of the award is to encourage the presentation before the American Welding Society of papers which are effective in promoting the use of welding.

The medal will be awarded each year to the author or authors of the paper, which in the judgment of the Board of Awards, represents the greatest original contribution to the advancement and use of welding. For the author, or authors, to be eligible for the award, the paper shall describe clearly original work done by them, or under their immediate supervision on welding in any of its aspects and by any method or process.

For the author or authors to be eligible for this award the paper shall have been published in the journal of the American Welding Society for the period intervening between the annual meetings of the Society. The paper shall have been presented, or scheduled for presentation, at any meeting of the American Welding Society or local sections.

Lincoln Gold Medal which is awarded annually by the American Welding Society.

AURORA WELDING SERVICE, 186 Woodlawn, Aurora, Ill., has just completed a series of practical lectures on welding application and design for welding in cooperation with the Lincoln Electric Co., Cleveland, Ohio. E. W. P. SMITH, consulting engineer for Lincoln Electric Co., was in charge of the lecture course which was given March 29th to April 2nd in the shop of Aurora Welding Service. Attendance at the lectures averaged 90 per lecture. Mr. Smith covered the fundamentals of arc welding, inspection of welds, qualification of operators and redesigning of machinery and engineering structures from castings or riveted designs to welded fabrication. In his last lecture he discussed analysis of stresses and their distribution with the aid of rubber models and also by using polarized light and transparent models of celluloid or bakelite.

Aurora Welding Service is a partnership of Geo. E. Lidecka and H. L. Schroeder.

A. P. I.-A. S. M. E. CODE (1938 Edition) has just been released by the American Petroleum Institute and the American Society of Mechanical Engineers. Section W of the new code covers design and construction of fusion welded vessels for petroleum liquids and gases. Other sections of the code cover riveted and integrally forged vessels. Probably of greatest interest to our readers are the pages covering fabrication procedure, inspections and tests, and installation of welded pressure vessels. This is included on pages 53 to 75 of the new code. Copies of this recently issued publication can be obtained at 75c each by writing to American Welding Society, 33 West 39th St., New York City, or the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

A. O. SMITH CORP., Milwaukee, Wis., established a shipping record recently when 54 brewery tanks left its yards during the week from March 21st to 26th.

The huge glass-lined tanks were all of electric-welded steel plate construction. They were built in 11 different sizes to meet specific space and capacity requirements of five widely distributed breweries. The dimensions run up to 12 ft. in diameter and 38 ft. in length and the combined capacity of the tanks is equivalent to nearly one-half million 10-oz. glasses of beer. Forty-five railroad cars were pressed into service to carry the record shipment.

Loading a welded brewery tank on a flat car.

A similarly heavy shipping schedule will be continued for some weeks, because of the seasonal rush of brewers to get their new equipment in operation for the summer.

ELEVATED HIGHWAYS to relieve congestion and to speed the flow of traffic through densely populated cities can be designed not only economically but aesthetically. This was proved by the 273 designs submitted in the competition just held by the AMERICAN INSTITUTE OF STEEL CONSTRUCTION. In view of the general excellence of the designs, even of those which won no prizes, all of the drawings were thrown open for exhibition to the public beginning April 8th at 200 Madison Ave., New York City.

The first prize of $5,000 goes to HAZELET & ERDAL, consulting engineers, of Chicago, Ill. Theirs was a streamlined design supporting a four-lane roadway upon a cantilevered floor beam supported on a central bent, the spread of the legs of which is sufficiently close not to impinge upon, but forms a center safety zone upon the street below. Such a design, it was felt, could be erected without causing consequential property damage and without impeding traffic on the underlying street.

"WELDED SKI JUMP TRESTLE AT BERLIN, N. H."—In the short article describing this interesting welded structure, which we published on page 30 of our March, 1938, issue, we omitted mention of The Hussey Manufacturing Co., North Berwick, Me. This structural steel fabricator handled the shop and field welding of the ski jump trestle.

R. A. CURRY, metallurgist with Central Steel & Wire Co., Chicago, addressed the students of the American Manganese Steel Co.'s welding school on March 31st. Mr. Curry's subject was "Stresses and Strains Set Up by Welding." This school is conducted under the supervision of WILLIAM GEORGE at the

Chicago Heights plant of American Manganese Steel Co. to give practical instruction in oxy-acetylene and arc welding of manganese and other alloy steels.

IOWA STATE COLLEGE, Ames, Iowa, reports an attendance of 446 at its 10th annual welding conference which was held March 22nd to 24th. D. C. FABER, director of engineering extension service, states that 270 of the 446 who registered at the conference had never before attended the Iowa State welding conference. From the standpoint of attendance and interest displayed in the educational features of the program, the conference was highly successful.

Personals

R. A. GEZELIUS, formerly associate metallurgist of the Naval Research Laboratory, Washington, D. C., has just been engaged as a metallurgist by the TAYLOR-WHARTON IRON AND STEEL CO., High Bridge, N. J. At the Naval Research Laboratory, Mr. Gezelius has done research work in physical metallurgy. Included in the work done has been research on gamma ray radiography, experiments to determine the mechanism of ageing in iron and steel, fundamental research on steel cast-

R. A. GEZELIUS

ings, and miscellaneous research such as preparation of experimental alloys, experimental heat treatment of alloys, corrosion testing and photo-micrographic work. In connection with the work on steel castings, one of the important phases has been that of determining the contraction of cast steel while cooling.

Before entering the Naval Research Laboratory, Mr. Gezelius studied at Michigan State College, where he received the degrees of bachelor of science in industrial chemistry and master of science in physical metallurgy.

ROLLO E. FALK, vice-president and general manufacturing manager of REVERE COPPER AND BRASS, INC., has been elected a director of the company. Mr. Falk has been manufacturing manager for Revere since 1932, and previous was works manager of the Dallas Division, in Chicago, Ill. Mr. Falk's headquarters are in New York.

LORENZO KENNON, in charge of the welding division of the MOORE MACHINERY CO., of San Francisco and Los Angeles, distributors of Westinghouse "Flex-arc" welders and Hollup "Sureweld" electrodes, was recently transferred from the San Francisco headquarters to the Los Angeles office.

THOMAS D. KETCHBAW has resigned from Metal & Thermit Corp., Dallas district office, to establish the INDUSTRIAL SCHOOL OF WELDING, 1915 Franklin Ave., Houston, Tex. Mr. Ketchbaw informs us that his welding school includes the subjects of heat-treating, flame-hardening and elementary metallurgy.

M. J. BONAVERO, formerly connected with Bethlehem Steel Co., has been appointed welding engineer of the Bolivar Welding Co., Bolivar, Pa.

H. S. STROUSE has been elected a vice president of Harnischfeger Corp., Milwaukee, Wis. Mr. Strouse will continue his duties as treasurer of the company, which position he has held since 1931. After graduation from Purdue University in 1915, Mr. Strouse entered the Chicago Central Station Institute. At the outbreak of the war he entered the first officers' training camp at Fort Benjamin Harrison, Indianapolis, Ind., and, after active service overseas with the 310th Regiment of

TITAN BRONZE WELDING ALLOYS

(Trade Mark Registered)

TITAN bronze welding alloys—doubly deoxidized to protect against formation of gases and oxides—are preferred by experienced welders everywhere.

Penn Bronze—is a general purpose rod. It is low melting (1620° F.) and tins easily and uniformly on galvanized, malleable or wrought iron as well as steel, brass, bronze and any other non-leaded metal with a melting point above 1850° F. It makes tough high-strength welds of high ductility, immune to strain hardening and with great abrasion and corrosion resistance.

Titan Manganese Bronze—is used where both hard and tough welds are desired. Although this is a general purpose rod, it is especially recommended for cast iron. It is free flowing and gives extremely dense, non-porous welds.

Titan Bronze—is a tin bronze with uses and characteristics similar to the manganese alloy; penetrates seams and crevices readily.

If you haven't tried these Titan Doubly-Deoxidized Welding Alloys, you are invited to send for samples. Test them, and prove to your own satisfaction that they produce welds of definitely greater strength and ductility.

Descriptive literature on request.

Titan Metal Manufacturing Company

Bellefonte, Pennsylvania

Engineers, was mustered out in 1919. After the World War he went to the Harnischfeger Corporation as an estimating engineer. In

H. S. STROUSE

1921 he was appointed advertising manager, and in 1931 was elected treasurer. Two years later he became a director of the company.

A. W. S. Activities

CLEVELAND SECTION, A. W. S.—At its meeting April 13th at the Cleveland Club, the Section conducted a discussion on the subject "Steel Castings—When, Where and Why?" This covered the advantages of steel castings with respect to other methods of fabrication and an effort was made to set up the basis of choosing between castings and built-up welded structures, and also the applications where steel castings and welding are complementary. The following men spoke on the subject: R. L. COLLIER, H. F. TIELKE, and F. J. STANLEY, the latter two representing the Crucible Steel Casting Co. of Cleveland.

NORTHERN NEW YORK SECTION, A. W. S.—"Progress in Resistance Welding" was presented to the Section by A. M. UNGER, welding engineer, Pullman-Standard Car Mfg. Co., with the aid of several reels of motion picture film. Mr. Unger described the applications of resistance welding used by Pullman-Standard in railway car building.

PHILADELPHIA SECTION, A. W. S.—At its meeting March 21 was addressed by R. F. JOHNSTON of the U. S. Steel Corp., his subject being "Fabrication and Uses of High Yield Strength Alloys."

MILWAUKEE SECTION, A. W. S.—At its meeting April 15th, held at the City Club, 756 N. Milwaukee St., Professor W. M. WILSON, University of Illinois, presented a paper "Recent Developments in Structural Welding." Professor Wilson described welding processes used on steel structures, non-destructive tests of welds and some of the service tests which have established the impact strength of welded joints.

CHICAGO SECTION, A. W. S.—At its last meeting April 15th the Section was addressed by E. R. SEABLOOM, research engineer, Crane Co., Chicago, on the subject "Application of Fusion Welding to Pressure Piping." Mr. Seabloom's activities have covered welding application to all types of piping. His talk covered code requirements, qualification of operators, procedure control, shop practice, stress relieving and surface hardening of valve seats.

DETROIT SECTION, A. W. S.—A meeting of Detroit Chapter was held on April 22nd at 8 o'clock, in the Alpine Room of the Detroit-Leland Hotel. R. T. GILLETTE of General Electric Co., Schenectady, N. Y., was guest speaker. The title of his paper was "Solving Practical Problems in Resistance Welding."

LOS ANGELES SECTION, A. W. S.—"Welding of Stainless Steel and High Tensile Steels" was the subject of a talk presented by VIRGIL W. WHITMER, metallurgist of Republic Steel Corp. at the Section meeting March 17th, held in the Central Manufacturing District Club Rooms, 4814 Loma Vista Ave.

SAN FRANCISCO SECTION, A. W. S.—HAROLD BELL, of the process service department of The Linde Air Products Co., was the speaker of the evening at the regular March meeting of the San Francisco Section, which was held Friday, March 18th, at the Athens Athletic Club, 12th and Clay Sts., in Oakland. The subject chosen by Mr. Bell was "Flame Hardening," and was illustrated by slides and motion pictures.

Following Mr. Bell's interesting and instructive talk, the meeting was turned into a general discussion of two topics: (1) "Should the Welding Society give an educational course for welding operators, and, if so, what should be taught?" (2) "Should the Welding Society give an educational course for engineers, designers, draftsmen, foremen inspectors and those having to do with making decisions as to whether or not and how welding should be used in fabrication? If so, what should be covered in such a course?" Chairman N. F. WARD presided.

SAN JOAQUIN VALLEY SECTION, A. W. S.—As a feature of the regular March meeting of the San Joaquin Valley Section, through the courtesy of L. F. FIFE, master mechanic of the Bakersfield Division of the Southern Pacific, members and guests were escorted on a tour through the railroad's shops in Bakersfield. Members of the shop force acted as guides and explained the various types of work done in different departments, procedure employed, particularly in welding.

The meeting was held in the Eagles Club Room, 1714 "G" St., in Bakersfield. Following the business session and preceding the railway shops visit, a motion picture was shown depicting the many phases of the oil industry, which has held an important place in the activity of that territory. Chairman B. RINTOUL presided.

NEW YORK SECTION, A. W. S.—"Welding of Silicon Bronze" was the subject presented at the April 19th meeting by JOHN J. VREELAND, metallurgical engineer, Chase Brass & Copper Co., Waterbury, Conn.

GRAND RAPIDS WELDING MEETING—On Monday, April 18th, a group composed of WARNER F. HAYS, managing director of American Welding Society; WILLIAM M. HAYES, of Detroit, district manager of Air Reduction Sales Co.; VAUGHAN REID, SR., chairman of Detroit Chapter, A. W. S.; and J. B. TEBBIN, manager of the P. R. Mallory

The Improved "Round File" Gas Lighter

Large File Area

The "Round File" construction provides a very large file area —*approximately one square inch.* This assures longer life for the lighter. The file is of superior quality and can be easily replaced.

Many superior design and construction features combine to make the Improved "Round File" the most economical and efficient lighter on the market. Get acquainted with Improved "Round File" and its many advantages.

Circular and prices on request.

SAFETY GAS LIGHTER CO. (Est. 1901) LYNN, MASS.

Co., Detroit, journeyed to Grand Rapids, Mich., to give talks on welding to a local group associated with the welding industry. The possibility of establishing a Grand Rapids chapter of the society is also to be considered at this time.

PHILADELPHIA SECTION, A. W. S.—"Welding in Modern Building Construction" by H. W. LAWSON, Bethlehem Steel Co., was scheduled for presentation at the April 18th meeting. A joint meeting with the Electrical Maintenance Engineers Association will be held on April 29th, at the Architects Bldg., 17th and Sansom Sts. H. S. CARD, National Electrical Manufacturers Association, will present the subject, "The Modern Welding Formula and How It Works."

DETROIT SECTION, A. W. S.—A highly instructive talk on "Welding as Applied to Ship Construction" was given by R. W. BRENDLE, of Great Lakes Engineering Works, before a large attendance of members of Detroit Chapter, at the regular monthly meeting March 17th, at Fort Shelby Hotel. VAUGHAN REID, chairman of the Section, presided.

Mr. Brendle augmented his graphic description of the new ships built for Ford Motor Company, with pictures showing construction of the ships in detail, stating that Mr. Ford is now completely sold on welded ships.

A committee was appointed to make arrangements for the National Convention of American Welding Society to be held in Detroit October 17th to 20th. J. B. TEBBIN was appointed temporary chairman, with F. M. HARVEY, WALTER ANDERSON, WILLIAM M. HAYES, OTIS SMITH, C. R. ECKSERGIAN and JOSEPH GESCHELIN, assisting. WILLIAM M. HAYES left for New York on April 13th to attend a program committee meeting to consider convention plans. MR. TEBBIN announces interesting plans already under way for the convention. A reception is to be held on Sunday, October 16th, preceding the opening of the convention on Monday.

Mayor RICHARD W. READING of Detroit will be on hand to greet members. The annual banquet will be held at the Book-Cadillac on October 20th with HARVEY CAMPBELL, vice-president of the Detroit Chamber of Commerce, as toastmaster.

Future Technical Meetings

April 28-29, 1938

Association of Iron and Steel Engineers, Empire Building, Pittsburgh, Pa.

Annual spring conference at Lord Baltimore Hotel, Baltimore, Md.

May 2-6, 1938

American Mining Congress—Annual Coal Mining Convention and Exposition at Music Hall, Cincinnati, Ohio.

May 10-12, 1938

American Society of Mechanical Engineers, 29 West 39th St., New York City.

Machine Shop Practice Division meeting at Rochester, N. Y.

May 14-21, 1938

International Petroleum Exposition & Congress, Exposition Grounds, Tulsa, Okla.

May 18-20, 1938

American Institute of Electrical Engineers, 33 West 39th St., New York City.

North Eastern District meeting at Lenox, Mass.

May 31-June 2, 1938

Heating, Piping and Air Conditioning Contractors National Association, 1250 Sixth Ave., New York City.

Annual Convention (49th)—Boston, Mass.

June 20-22, 1938

Society of Chemical Industry, 305 Washington St., Brooklyn, N. Y.

Annual meeting in Ottawa, Ont.

June 20-24, 1938

American Institute of Electrical Engineers, 33 W. 39th St., New York City.

Summer convention at Washington, D. C.

June 20-24, 1938

American Society of Mechanical Engineers, 29 West 39th St., New York City.

Semi-annual meeting in St. Louis, Mo.

June 27-July 1, 1938

American Society For Testing Materials, 260 So. Broad St., Philadelphia, Pa.

Annual meeting at Chalfonte-Haddon Hall, Atlantic City, N. J.

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EXTRA FLEXIBLE
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● **The ideal welding cable must be flexible, must stand abuse and be perfectly insulated.**

Okocord Welding Cable embodies these three attributes. It is extremely flexible, because the conductor is made of a great many fine copper wires. It withstands mechanical abuse because it is made with a jacket of tough, tire-tread type of 60% rubber. It has perfect insulation because it is insulated by The Okonite Company —an acknowledged leader in the insulation field since 1878.

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August 9-12, 1938

American Institute of Electrical Engineers, 33 W. 39th St., New York City.

Pacific Coast convention at Portland, Ore.

September 27-30, 1938

Association of Iron and Steel Engineers, Empire Building, Pittsburgh, Pa.

Annual convention and Iron and Steel Exposition in the Cleveland Public Auditorium, Cleveland, Ohio.

October 5-7, 1938

American Society of Mechanical Engineers, 29 West 39th St., New York City.

Fall Meeting at Providence, R. I.

October 10-14, 1938

American Institute of Steel Construction, Inc., 200 Madison Ave., New York City.

Annual meeting at French Lick Springs, Ind.

October 17-21, 1938

National Metals Congress & Exposition, held in conjunction with American Welding Society, American Society for Metals, American Society of Mechanical Engineers, American Institute of Mining & Metallurgical Engineers, and The Wire Association. Annual meeting in Detroit, Mich.

November 14-18, 1938

American Petroleum Institute, 50 West 50th St., New York City.

Nineteenth annual meeting at the Stevens Hotel, Chicago, Ill.

November 28-30, 1938

American Institute of Electrical Engineers, 33 West 39th St., New York City.

Southern District meeting at Miami, Fla.

December 5-9, 1938

American Society of Mechanical Engineers, 29 West 39th St., New York City.

Annual meeting in New York City.

December 5-10, 1938

National Exposition of Power and Mechanical Engineering will be held at Grand Central Palace, New York City.

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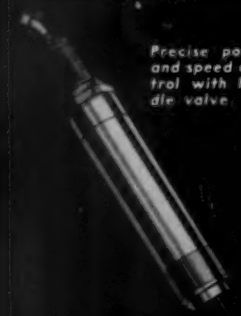
B1 SCALING TOOL

The Slickest Tool You Ever Saw!



Precise power and speed control with handle valve.

Chisel cannot twist or loosen accidentally. Exhaust blows off chips.

Try a CLECO B1 on your own work. You will agree there's no tool its equal for cleaning weld splatter; undercutting where overlapping is necessary; peining bead; taking off rust and old paint; removing sand from intricately cored castings such as motor blocks.

The harder you press a CLECO B1, the harder and faster it hits. The chisel can't loosen until you touch the thumb latch—it can't twist, no matter what you do, until you remove it.

Make us prove it in your plant—and let us mail you Bulletin 84.

THE CLEVELAND PNEUMATIC TOOL COMPANY

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BRANCHES IN PRINCIPAL CITIES

Trade News

A. H. Friese, president of Welding Engineering Co., 264 East Ogden Ave., Milwaukee, Wis., announces that expansion of his business has compelled him to move into larger quarters. In his new shop he has over 3,700 sq. ft. of floor space. Complete facilities are available for oxy-acetylene welding and cutting and arc welding. His company is primarily engaged in the selling of new and rebuilt welding equipment, but a welding school is another one of Mr. Friese's interests. To celebrate his nearly twenty years experience in the welding industry, Mr. Friese and his wife have just taken a trip to Bermuda—a "second honeymoon."

Lincoln Electric Co., Cleveland, Ohio, will feature its new diesel engine driven arc welder at the tenth annual National Petroleum Exposition and Congress at Tulsa, Okla., May 14 to 21, 1938. The new welder compares favorably with gasoline engine driven arc welders in price, weight and operating speeds. This new machine brings the economies of diesel operation to construction of pipe lines and other applications requiring engine-driven arc welders.

The Linde Air Products Co. in conjunction with Electro Metallurgical Co. will exhibit at the Foundry and Allied Industries Exposition, to be held May 14th to 19th in the Public Auditorium, Cleveland, Ohio. The Linde Air Products Co. will show various applications of the oxy-acetylene process which are helping foundries reduce operating costs.

The Linde Air Products Co. in conjunction with Haynes Stellite Co. and National Carbon Co., Inc., also units of Union Carbide and Carbon Corp., will exhibit at the International Petroleum Exposition, to be held May 14th to 21st, in the California Building, Tulsa, Okla. The Linde Air Products Co. will feature multi-flame Lindewelding, the welding of oil well casings, portable cutting machines for preparing pipe and plate, and other oxy-acetylene applications in the oil industry.

The Haynes Stellite Co. display will emphasize the wide variety of oil field applications for the hard-setting and hard-facing

materials — Haystellite Inserts, Haystellite Composite Rod, Tube Haystellite, Haynes Stellite welding rod, and Hascrome, Haystellite cast tungsten carbide products, for protecting the cutting and reaming edges of oil well drilling bits. The methods of using them to best advantage, will be featured.

THE HARNISCHFEGER CORP. of Milwaukee, Wis., announces the appointment of two new distributors in North Carolina. THE CONSTRUCTORS SUPPLY CO., INC., at Durham, N. C., has been appointed as exclusive excavator agent for the entire state, and will also represent the P&H line of welders and hoists on a non-exclusive basis. THE NORTH CAROLINA EQUIPMENT CO., located at Releigh, N. C., will handle the sale of P&H hoists and welders on a non-exclusive basis.

AIR REDUCTION CO. and its affiliated organizations, the WILSON WELDER AND METALS CO., INC., and NATIONAL CARBIDE CORP. will have an exhibit of their products and processes of particular interest to members of the petroleum industry, in booths 30 to 34 at the International Petroleum Exposition to be held at Tulsa, Okla., during the week of May 14th. The latest techniques and improvements in equipment used in the Airco-welding and electric arc welding of piping and casing will be demonstrated.

In addition to displaying Airco's group of welding and cutting gases, equipment and supply items, the exhibit will feature the Wilson "Yellow Jacket," a machine especially designed and built to meet the needs and conditions of pipe line and casing welding.

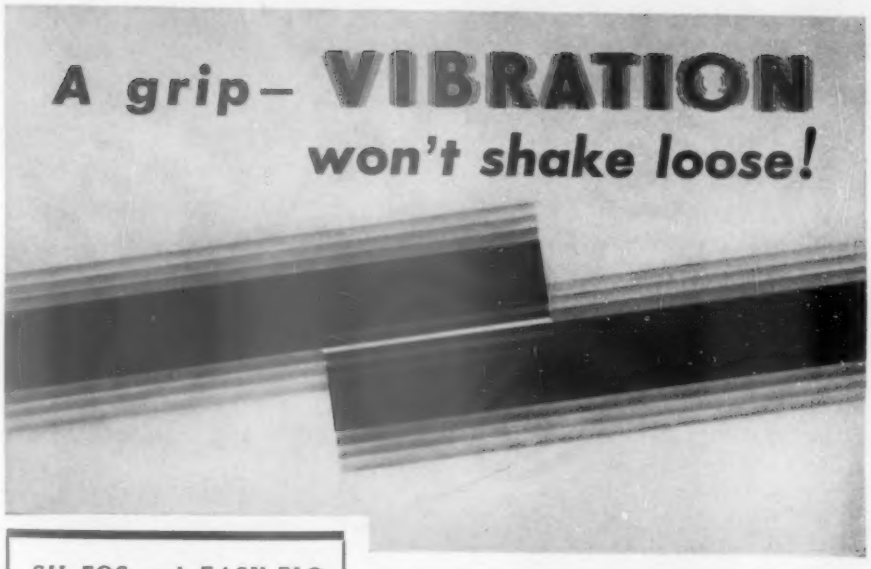
THE BLACK & DECKER MFG. CO. announces the opening of a factory service branch at Indianapolis, Ind., located at 935 N. Illinois St. This branch carries a complete stock of genuine replacement parts for all Black & Decker tools. H. F. LINDER is service representative at Indianapolis and M. D. MOOERS of the sales department will make this his headquarters.

Recent Patents

SAFETY APPARATUS FOR FUEL CONTAINERS—2,106,750. NICHOLAS E. KOCH, Los Angeles, Calif. Issued Feb. 1, 1938. Filed May 31, 1934. A fuel tank having a filler opening with a closure means therefor, an inlet pipe connected to an upper portion of the tank, said tank having an outlet adjacent an upper portion and remote from the inlet pipe, an exhaust pipe adapted for connection to an internal combustion engine and having a discharge opening, the inlet pipe being connected to the exhaust pipe, and a by-pass valve to by-pass a portion of the exhaust gases from the exhaust pipe through the inlet pipe to the tank. For welding repairs to gasoline tanks.

WELDING CLAMP

2,108,077. VAN K. ROBINSON, Bremerton, Wash. Issued Feb. 15, 1938. Filed Dec. 2, 1935. A clamp for securing a plurality of



SIL-FOS and EASY-FLO make strong, vibration-resisting joints for many industries, including makers of —

AIRPLANE EQUIPMENT
AUTOMOTIVE PARTS
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PIPE AND FITTINGS
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TRANSFORMERS
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TURBINE BLADING
VALVES
WELDING APPARATUS
WIRE AND CABLE
WIRE MESH AND CLOTH
—AND MANY OTHERS

If you have a problem in joining either ferrous or non-ferrous metals, we'll be glad to cooperate in solving it—write us today.

WHEN LOW TEMPERATURE SILVER BRAZING ALLOYS take hold of metals they join them with a permanent grip. Joints are strong and have a ductility that makes them reliable, even under constant vibration or heavy shocks.

This feature of low temperature alloys comes from the silver they contain. It makes them extremely liquid at temperatures as low as 1175° F. They penetrate quickly to every crevice of a joint and diffuse into metal surfaces. A thin, ductile film imbedded in the parts joined makes a joint as sound as solid metal.

This high strength, plus ability to absorb jars, jolts and vibrations are important reasons why so many manufacturers now use the low temperature alloys Sil-Fos and Easy-Flo.

Have you tried these alloys on your work? They make *reliable* joints at low cost with savings in gas, labor and finishing costs.

WRITE FOR SIL-FOS AND EASY-FLO DETAILS

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Ryerson a dependable source for Welding Rod

● Ryerson Engineers have developed a series of rods that are outstanding for Quality production. More than twenty types, including both electric and gas rods, are carried in stock. Whether you need a shielded arc type for production work or a stainless steel rod you can be sure of immediate shipment... *Write for Bulletin which gives complete data.*

Ryerson
Shielded Arc Type
No. 215
Shielded Arc Type
No. 216
Shielded Arc Type
No. 217
Green Processed No. 18
Copper Coated No. 206
Copper Coated No. 210
Cast Iron

ELECTRODES

Ryerson
Green Processed No. 6
Bare Mild Steel
Brown Processed
White Flux Coated
High Carbon White Flux
Coated
Blue Flux Coated

GAS RODS
3½% Nickel Steel
High Carbon Bare
No. 2110

Ryerson
3½% Nickel Steel Flux
Coated
High Manganese Steel
Hard Surfacing
Allegheny Stainless Flux
Coated
Allegheny Stainless No. 44

Tobin Bronze
Allegheny Stainless Bare
Hard Filler

JOSEPH T. RYERSON & SON, Inc., Chicago, Milwaukee, St. Louis, Detroit,
Cleveland, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

pipe sections in fixed relative position comprising angle iron means provided with angularly disposed contact surfaces adapted to engage a pipe section at points spaced on its periphery. Also spaced along the length of the pipe and means for securing the pipe section on the angle iron means comprising a pair of spaced apart yokes having inturned ends, one inturned end of each yoke having a hinge slot therein and a common hinge pin means secured to the side of the angle irons. The other inturned end of each yoke being extendible under said angle iron to abut against in secured position.

FLEXIBLE WELDROD

2,107,434. LINCOLN B. WILSON, Barberton, Ohio, assigned to The Babcock & Wilcox Co., Newark, N. J. Issued Feb. 8, 1938. Filed July 13, 1933. In a weldrod, a flexible metal core, and an enshrouding covering containing a metallic compound, and a nitrogen-free gum or resin-like component in an amount sufficient to render the covering cold plastic to a degree permitting bending through at least 90 deg. without separation of core and covering.

Trade Literature

WILLSON PRODUCTS, INC., of Reading, Pa., has just issued a new catalog of industrial safety devices. This firm is said to have been the first company to specialize in the manufacture of safety devices for the protection of industrial workers.

The catalog, which is well illustrated, covers the complete Willson line of eye, nose, throat and lung protectors. Included are more than 50 types of goggles for every conceivable purpose, a dozen welding hand-shields and helmets, seven United States Bureau of Mines approved types of dust respirators, air line respirators, abrasive helmets, etc. Copies may be obtained free by writing Willson Products, Inc., 274 Thorn St., Reading, Pa.

"CATERPILLAR DIESEL ENGINES"—Maximum and rated performance curves of the seven current sizes of "Caterpillar" diesel engines are included in a new booklet issued by Caterpillar Tractor Co. Printed in three colors, the book is a brief resume of the outstanding features of the diesel engine. Mechanical features as well as a discussion of the materials that are used in construction, are also included.

Copies of this booklet may be obtained by writing Caterpillar Tractor Co., Peoria, Ill., and specifying Form 4253.

"1,000 COMBINATIONS" is the title of a new bulletin just issued by Hobart Brothers, Troy, Ohio, describing this company's new model Multi-Range Arc Welder. It is pointed out in this bulletin that the dual-control makes available 1,000 combinations of voltage and current. A description of this improvement in the Hobart arc welder will be found in the "New Products" department of the next issue.

BLACK & DECKER MFG. CO., Towson, Md., has just issued its annual complete line catalog. Among the power tools described are portable drills, grinders and polishers, such as commonly used in welding shops.

THE VAN DORN ELECTRIC TOOL CO., Towson, Md., has issued its 1938 catalog of portable tools. Among the portable tools described are power drills, shears, screw drivers, nut runners, grinders, sanders and polishers.

"A MAJOR IMPROVEMENT IN SHOP WELDING METHODS with the New Ransome Revolving Table" is the title of a circular just issued by RANSOME CONCRETE MACHINERY CO., Dunellen, N. J. A copy will be sent to anyone asking for Bulletin No. 151.

"LINCOLN 'SHIELD-ARC SAE' WELDER" is the title of a four-page bulletin (No. 327) just issued by The Lincoln Electric Co., Cleveland, Ohio, describing its Type S-6037 300 amp. diesel engine driven welding generator. Technical description of this piece of equipment is included in our "New Products" department.

Send For Your Copy of this new bulletin on

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Introducing two new electrodes for applying wear-resisting surfaces to new parts or for building up worn parts. Very easy to use—with either arc or oxy-acetylene process.

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